



BRITISH
COLUMBIA

Ministry of Employment and Investment
Energy and Minerals Division
Geological Survey Branch

**EXPLORATION
IN BRITISH COLUMBIA
1996**

British Columbia Cataloguing in Publication Data

Main entry under title:

Exploration in British Columbia - 1975 -
Annual.

With: Geology in British Columbia, ISSN 0823-1257; and,
Mining in British Columbia, ISSN 0823-1265, continues: Geology,
Exploration, and Mining in British Columbia, ISSN 0085-1027
1979 published in 1983.

Issuing body varies: 1975-1976, Ministry of Mines and
Petroleum Resources; 1977-1985; Ministry of Energy, Mines and
Petroleum Resources; 1986-1995; Ministry of Employment and
Investment 1996 - Geological Survey Branch. ISSN - 0823-2059 -
Exploration in British Columbia.

1. Prospecting - British Columbia - Periodicals. 2. Geology,
Economic - British Columbia - Periodicals. I. British Columbia.
Ministry of Energy, Mines and Petroleum Resources. II.. British
Columbia. Ministry of Employment and Investment

TN270.E96 6221'09711

Revised April 1987



VICTORIA
BRITISH COLUMBIA
CANADA

November, 1997

FOREWORD

This is the twenty-second edition of *Exploration in British Columbia*, a volume dedicated to providing a review of the past year's mineral industry activity. For the first time this volume is being published on the world wide web, as well as the more conventional hard copy version.

During 1996 British Columbia exploration activity for metals was primarily concentrated in the north and central parts of the province targeted at porphyry, vein and sedex deposits such as Prosperity, Bronson Slope, Red Mountain, Akie, Golden Bear, Taurus, Specogna, Polaris-Taku, Hearne Hill, Mac, Lorraine, JD, Tsacha and Clone. Three large, open-pit, porphyry-type deposits (Kemess South, Huckleberry and Mount Polley) were in construction phase, with estimated capital costs totalling approximately \$650 million. Fourteen metal mines were operating in the province during the year. Four metal mines closed (Nickel Plate, Similco, Premier and Goldstream); there were no new mine openings. Clean coal production from eight mines in 1996 increased from 1995 as many mines recently completed major expansions and were fine tuning long-term mine plans.

Solid mineral production in British Columbia for 1996 is estimated at \$3.06 billion, a 12% decrease from 1995. Lower metal prices, a stronger Canadian dollar, and lower production due to mine closures have led to the decreased value of output. Gold production is estimated to be 17.8 million grams (572 oz) with a value of about \$304.3 million. The Eskay Creek mine produced 6113 kilograms (196 550 oz) of gold. Silver output is estimated to be 480 million grams (15 432 000 oz) valued at \$109.6 million, and up due to increased production at the Eskay Creek mine (309 480 Kilograms). Zinc and lead production are estimated to be 157.5 million kilograms and 53.4 million kilograms respectively - worth an estimated \$219 million and \$56.8 million, respectively. Production of industrial minerals is estimated to have a value of \$43.8 million, while structural materials accounted for a further \$419.1 million. Total coal production is estimated to be 25.6 million tonnes value at \$1.07 billion.

Spending on mineral exploration increased significantly to about \$116 million. This was in part attributable to increased exploration at active mines and the release of geochemical and geophysical survey data in the Cry lake and East Kootenay areas respectively. The number of claim units recorded in 1996 indicates a 15% increase in the level of activity over 1995. The number of Free Miner Certificates recorded for 1996 is estimated to be down by 9% from 1995.

In 1996 the British Columbia government allocated approximately \$500 000 under its Prospectors' Assistance Grant Program, to encourage mineral exploration and resource development.

The British Columbia Geological Survey Branch maintained an active program of fieldwork during the year, including a regional mapping program, mineral deposit studies, mineral potential evaluation, industrial minerals research, surficial geology and geological hazards investigations, regional geochemical studies, and joint projects with the Geological Survey of Canada in geophysics and regional mapping (including NATMAP). The results of these project activities were published in *Geological Fieldwork 1996*, Paper 1997-1 and in other ministry publications. Much of the data can also be viewed on the ministry website at: <http://www.ei.gov.bc.ca/geology/>.

W.R. Smyth
Chief Geologist

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BRITISH COLUMBIA MINING, DEVELOPMENT AND EXPLORATION 1996 OVERVIEW

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INTRODUCTION

Three large, open-pit, porphyry-type deposits (**Kemess South, Huckleberry** and **Mount Polley**) are in the construction phases, with estimated capital costs totalling approximately \$650 million. The three mines, scheduled to be in production in 1998, collectively will create approximately 700 new, full-time jobs and an estimated 1500 indirect jobs.

The historic **Bralorne** gold mine is scheduled to re-open in 1997. The **Golden Bear** mine is poised to go back into production in the summer of 1997 as a bulk-mineable, heap leaching gold operation. After a hiatus in exploration in 1995, the **Red Mountain** gold project had the largest expenditure at approximately \$8 million in 1996.

Exploration expenditures in 1996 are estimated to be approximately \$100 million. The number of projects in 1996 with budgets in excess of \$100 000 are estimated at approximately 210, a 13% decrease from 1995. Drilling in the province in 1996 is estimated to total approximately 500 000 metres, with approximately 40% of the meterage having been done in the northwest region. Targets included many of the classic deposit types for which British Columbia is known. Individual deposit examples include: **Specogna (Cinola)**, **Prosperity (Fish Lake)**, **Polaris-Taku**, **Red Mountain**, **Taurus**, **Golden Bear**, **Telkwa Coal**, **Tsable River**, **Akie**, **Ladner Creek (Carolin)**, **Cariboo Gold Quartz**, **Giant Copper**, **Tsacha**, and porphyries in the **Babine Lake** area.

Lower metal prices, a stronger Canadian dollar, and lower production due to mine closures have led to decreased value of output (approximately 12%) at existing mines. The total metals output by value is down approximately 24% from the 1995 estimate. Four metal mines closed during the year: **Nickel Plate**, **Similco**, **Premier** and **Goldstream**. However, gold and silver production increased significantly at the **Eskay Creek** mine, where exploration has also been very successful in adding to the reserve base.

Clean coal production in 1996 is expected to increase by 12% over 1995. Exploration at coal mines and off leases increased by about 8%, the latter was led by expenditures at **Telkwa**, **Tsable River** and **Willow Creek**. Predictions are for strong thermal coal markets. Although estimated expenditures for industrial minerals are down, there is strong interest in the wide variety of such commodities produced in British Columbia.

The number of claim units (approximately 38 380) recorded in 1996 indicates an increase of about 15% in the level of activity over 1995; however, there is still a very significant number of claim units forfeited (approximately 28 800). The number of Free Miner Certificates recorded for 1996 is estimated at 5460, down approximately 9% from 1995.

Several bulk sampling projects were carried out (*e.g.* **Brett**, **Pellaire**, **Telkwa Coal**). A number of advanced projects in the Environmental Assessment Process are in the feasibility stage (*e.g.* **Tulsequah Chief**, **Red Mountain**, **Telkwa Coal**, **Bronson Slope**, **Golden Bear**, and **Red Chris**). The Mining Association of British Columbia estimates that approximately \$1.7 billion worth of new projects are in the approval process and these projects have the potential to create 2400 new, high-paying jobs. Some projects (*e.g.* **Mt. Milligan** and **Cirque**) have received Mine Development Certificates and await production decisions. Of real concern, however, is the very low level (*i.e.* 12%) of grassroots or generative expenditures.

In 1996 the Geological Survey Branch released regional geochemical survey (RGS) data for the **Cry Lake** (NTS 104 I) map sheet; this resulted in the staking of several new claims. The Survey also completed sampling in the **Toodoggone River** (NTS 94E) and **McConnell Creek** (NTS 94D) map sheets and will release the data in 1997. The survey also released airborne geophysical data from the **East Kootenay** project which led to new claims staking. It also completed the final block of the survey and will release the results in 1997. The British Columbia government allocated approximately \$500 000 for

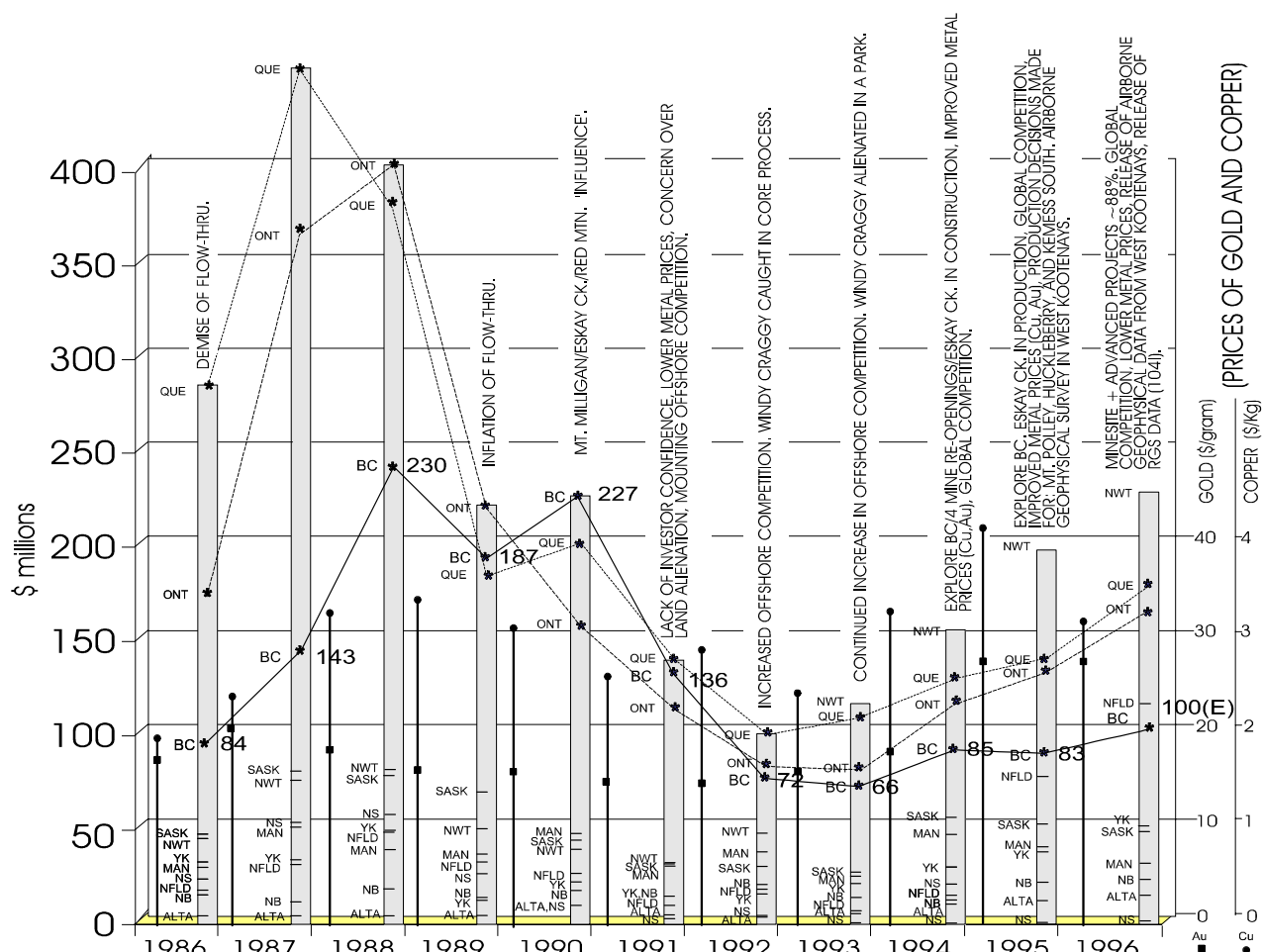


Figure 1. Mineral Expenditures in British Columbia relative to other Canadian provinces 1986 to 1996

exploration under its **Prospectors Assistance** program. Positive and encouraging results have been reported.

REGIONAL TRENDS

Preliminary estimates indicate that total expenditures on exploration and development projects in British Columbia during 1996 have been approximately \$100 million, an increase of about 20% over 1995. Much of this significant increase is attributed to increased spending at active mines in search of new resources, the advancement of many projects which are either in the Environmental Assessment Process or are close to entering it, and the government release of geochemical and geophysical survey data in the Cry Lake and East Kootenay areas respectively.

As in previous years, approximately 45% of total expenditures was spent in the northwest part of the province. The very low level of expenditures on grassroots or generative projects (*i.e.* 12%) is of concern. All regional Ministry offices recorded

increases in exploration spending in their respective areas in 1996: Smithers (+29%), Prince George (+14%), Kamloops (+44%), Cranbrook (+12%), and Vancouver (+25%).

Figure 1 illustrates the fluctuation of exploration expenditures in British Columbia compared to the rest of Canada over the past decade. Included are comments, along with the average annual prices for copper and gold, which influenced the increase or decrease in expenditures over that period. The peak year 1988, with expenditures of \$230 million, coincided with the height of flow-through funding. In subsequent years, expenditures show a steady decline to a low of \$66 million in 1993.

Although slight increases have occurred since then, annual expenditures in the \$130 million to \$140 million range are considered necessary by industry to sustain a healthy, viable mining industry in British Columbia. For the same ten-year period, the pattern of exploration spending is broadly similar to changes in the total value of solid mineral production (Figure 2); the latter indicates a much more dramatic increase in

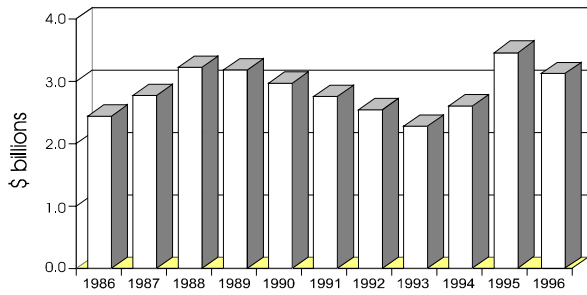


Figure 2. Solid mineral production value in British Columbia 1986 to 1996 (Source: MEI, Resource Policy Branch)

1995, followed by a 12% decline in 1996. Exploration targets are varied and include: vein deposits (epithermal and mesothermal) massive sulphide deposits (volcanogenic, sedex and seafloor hydrothermal), porphyry and related deposits, skarn deposits, industrial minerals deposits, coal deposits, placer deposits and others (e.g. magmatic) (Figure 3a). Porphyry and related deposits continue to be the most significant target (41.5%), followed by veins (32.5%).

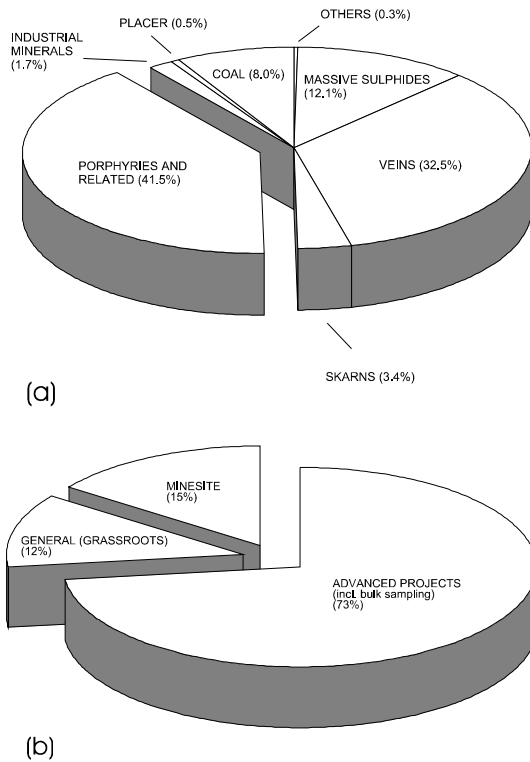


Figure 3. Exploration targets 1996 (a) by deposit type (%); (b) by level or category of programs.

Approximately 15% of exploration expenditures (including 3.6% at coal mines) were at minesites and 73% on advanced projects, including bulk sampling and environmental programs. An estimated, very low level of 12% was spent on less advanced or grassroots/generative exploration programs (Figure 3b). In total, there were approximately 210 projects with

budgets in excess of \$100 000, down about 13% from 1995. Approximately 50.5% of expenditures were in the \$100 000 to \$200 000 range. Those projects (27) with budgets over \$1 million accounted for approximately 58% of the total; those (20) in the range \$500 000 to \$1 million accounted for an additional 12.8% of the total, thus collectively accounting for approximately 71% of the total expenditures. Figures 4a and 4b show the number of projects with expenditures in excess of \$100 000. The largest program was by Royal Oak Mines Inc. on the **Red Mountain** gold project, southeast of Stewart, estimated at \$8 million. Expenditures in excess of one million dollars were also directed at re-evaluation of advanced projects such as: **Specogna (Cinola)**, **Prosperity (Fish Lake)**, **Telkwa Coal**, **Golden Bear**, **Premier**, **Similco**, **Cariboo Gold Quartz**, **Taurus**, **Akie**, **Ladner Creek** and **Red Chris**. The discovery of the **Clone** gold prospect, south of Red Mountain, in late 1995 led to increased exploration in the area in 1996.

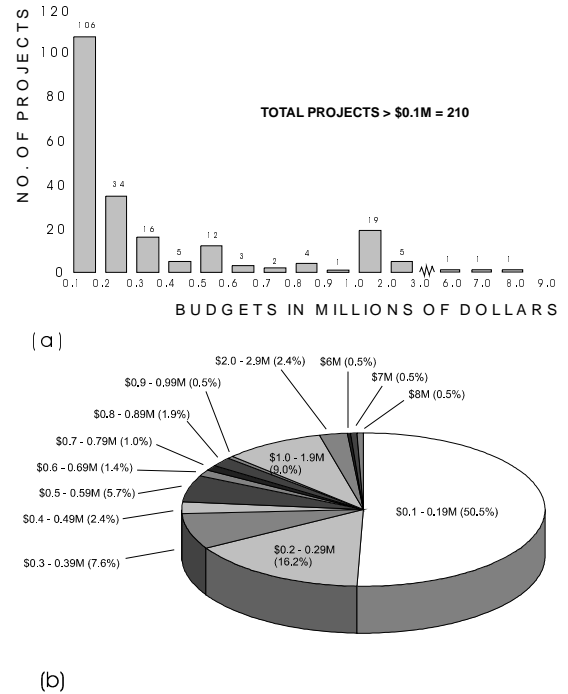


Figure 4. Estimated number of major projects (>\$100,000) (a) by incremental \$0.1M; (b) by percentage of total expended.

Grassroots programs were carried out in the northern (**Cariboo** area) and southern (**Philip Lakes** to **Toodoggone** areas) Quesnel Trough areas and the **Babine Lake** region for gold-enriched porphyries, in southeastern (**Sullivan** area) and northeastern (**Gataga** area) parts of the province for sedex deposits, in the **Interior Plateau** region of south-central British Columbia, in the **Toodoggone** region of northwestern

British Columbia for bonanza and bulk-mineable epithermal gold, in the **Stewart** camp in the northwest for mesothermal and transitional gold deposits similar to Snip and Red Mountain, in the Cassiar camp for bulk-mineable, heap leachable gold deposits, and in the **Wells-Barkerville-Likely** camps for mesothermal veins and bulk-mineable gold. Two projects targeted porphyry molybdenum potential, the **Salal** and **Crow-Rea** prospects located northwest of Pemberton and Summerland respectively. Exploration expenditures decreased for industrial minerals, but increased significantly for coal.

HIGHLIGHTS AT OPERATING MINES

The 14 metal mines operating in British Columbia in 1996 are indicated in Figure 6. There were no new mine openings, and the following four metal mines closed during the year - **Nickel Plate**, **Similco**, **Premier** and **Goldstream**. Many mines had significant exploration programs, some with good results. Several small high-grade projects (*e.g.*, Brett) have the potential to produce using custom milling arrangements (Table 1; *see* also Operations).

The number of direct mining employees in British Columbia in 1996 is estimated at approximately 9800 with wages totalling \$565 million.

The forecast value of solid mineral production for 1996 in British Columbia is \$3.05 billion, a 12% decrease from 1995 (Figure 7; Table 2).

Coal represents 37%, at a projected value of approximately \$1.13 billion, a 12% increase from 1995. Copper represents 23%, at a projected value of approximately \$700 million. These decreases in copper production reflect the closure of the Island Copper mine at the end of 1995, the closure of the Similco mine in November, 1996, the closure of the Goldstream mine in January, 1996, and the lower production volumes achieved at the Highland Valley Copper operation. During 1996 copper prices fell by approximately 34%.

The production of gold is forecast to be 18.5 million grams (575 400 oz) valued at \$320 million, down slightly from 19.8 million grams (636 000 oz) last year, primarily due to lower production from

Nickel Plate (closed, Oct. '96), closure of the Island Copper mine at the end of 1995, closure of the Premier mine in April, 1996 and less output from smaller, high-grade custom-milling operations.

Increases in gold production are expected from the **Eskay Creek**, **QR** and **Table Mountain** gold mines. Silver output is forecast at 450 million grams (14 million oz) valued at \$105 million, up about 12% from 1995 due to increased production at the **Eskay Creek** mine. Zinc production in 1996 is forecast to be 140 kilograms worth \$206 million and lead output is forecast to be 45 million kilograms valued at \$50 million; both represent slight increases from 1995. The total metals value is down approximately 28% from the

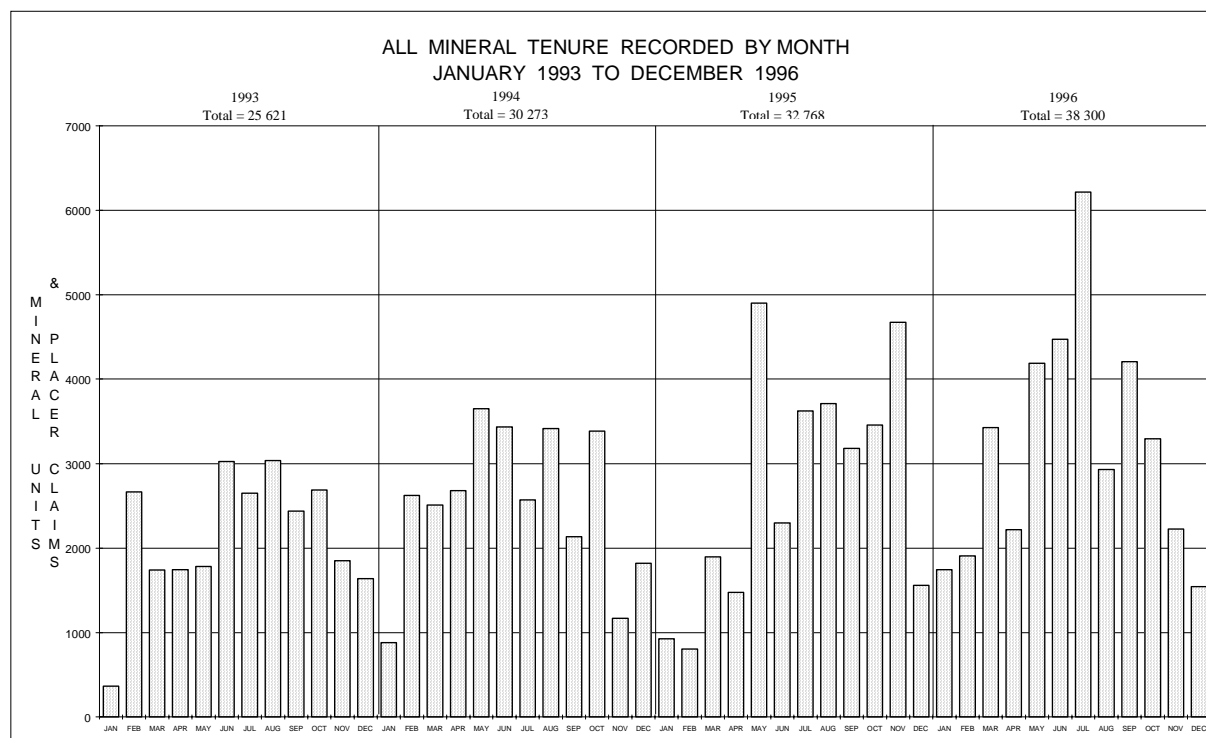


Figure 5. All mineral tenure recorded by month 1993 to 1996. Note: High value for July reflects releases of a Regional Geochemical Survey for the Cry Lake (104I) map sheet and of geophysical data from the East Kootenay region.

TABLE 1
ACTIVE AND POTENTIAL CUSTOM MILLING PROJECTS

Mill or Smelter/ Location	Project Name (Potential)	Commodity	Operator
Asarco/Helena, Montana	*Elk	Au	Fairfield Minerals Ltd.
Trail	*Brett	Au	Huntington Res. Ltd.
Trail	*Pellaire	Au	Int'l Jaguar Equities
Trail?	(Skinner)	Au	Ottarasko Mines Ltd.
Kettle/Republic, Washington	(Iron Colt, Evening Star, Midnight)	Au	Pacific Vangold Res. Inc./ Int'l Silver Ridge Res. Inc.
Afton/Kamloops, B.C.	(Alwin)	Cu, Au	Claimstaker Res. Ltd.
Premier/Stewart, B.C.	(Debbie)	Au	White Hawk Ventures Inc.
Premier	(Greens Creek, Alaska)	Au,Cu,Ag,Pb,Zn	Kennecott Corp./Hecla Mining Co./ CSX Energy Corp./Exalas Res.
Premier	(Johnson River)	Au,Cu,Ag,Pb,Zn	Westmin Res. Ltd.
Premier	(Jualin)	Au	Coeur d'Alene Mines Ltd.
Premier	(Red Mtn.)	Au,Ag	Royal Oak Mines Inc.
Premier	*Snip	Au	Prime Resource Group Inc.
Premier	(SB)	Au	Tenajon Res. Ltd./Westmin Res. Ltd.
?	(Engineer)	Au	Ampex Mining
?	(Valentine Mtn.)	Au	Beau Pre Explorations Ltd.
?	(Lexington)	Au	Britannia Gold Corp./Bren-Mar Res.

* = Active

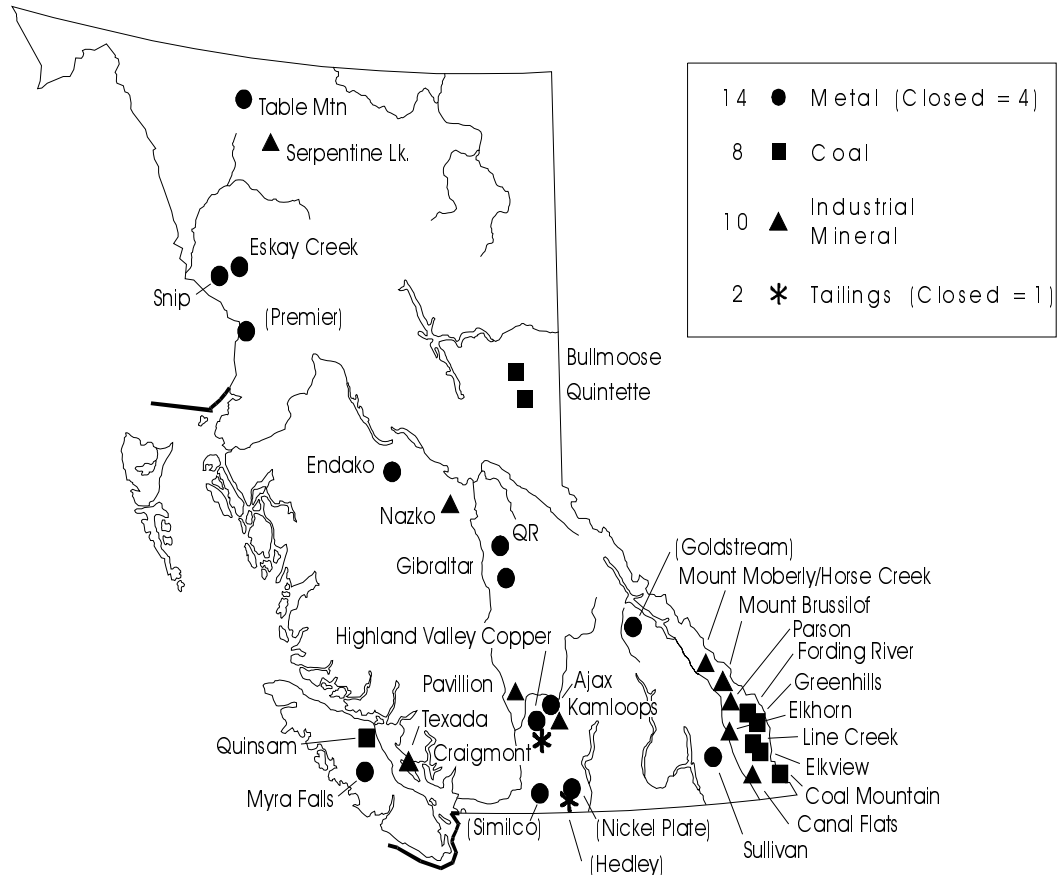


Figure 6. Operating mines in British Columbia, 1996.

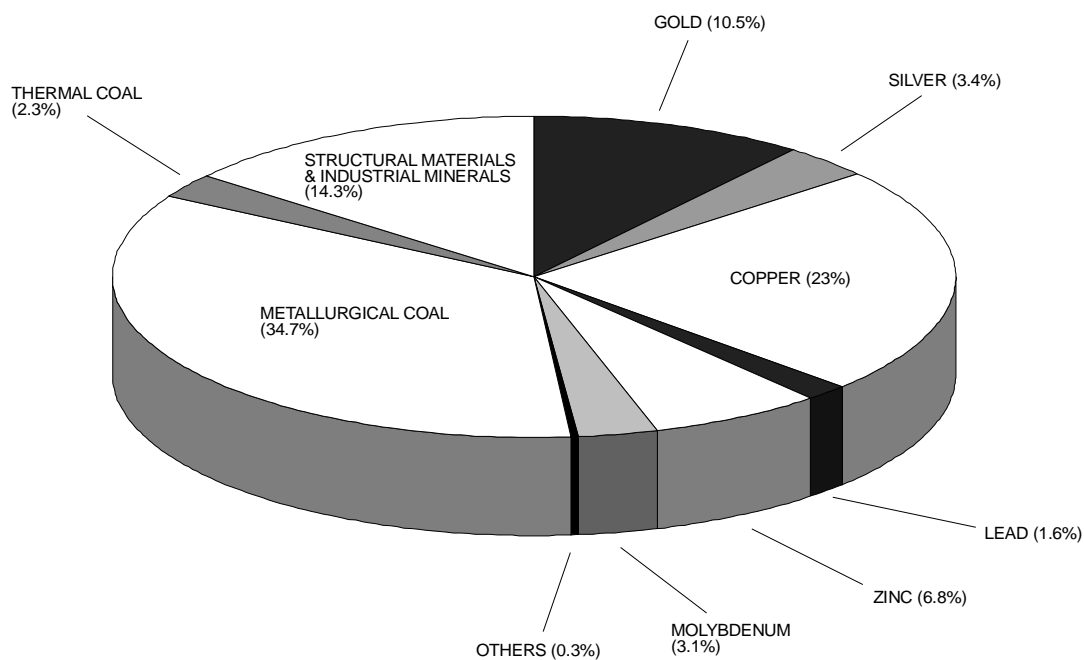


Figure 7. Forecast value(%) of mineral production in B.C. - 1996.

TABLE 2
1996 FORECAST VALUE OF MINERAL PRODUCTION IN B.C.

Commodity	Quantity (millions)	C\$ Value (millions)	Percent of Total Value
Metals			
Copper	230 kg	700	23.00%
Gold	18.5 g	320	10.50%
Zinc	140 kg	206	6.80%
Lead	45 kg	50	1.60%
Molybdenum	8 kg	96	3.10%
Silver	450 g	105	3.40%
Other		10	0.30%
Total Metals		1 487	48.70%
Coal			
Metallurgical Coal	22.20 t	1 061	34.70%
Thermal Coal	2.25 t	69	2.30%
Total Coal		1 130	37.00%
Total Others		435	14.30%
(Includes Structural Materials & Industrial Minerals)			
Total Solid Minerals		3 052	100%

Source: MEI Resource Policy Branch

1995 estimate.

The value of production from industrial minerals and structural materials is forecast to be approximately \$435 million in 1996, down very slightly from 1995.

OPERATIONS

METAL MINES

Production during 1995 at the **Eskay Creek** gold-silver mine, operated by Homestake Canada Inc., through 50.6% - owned Prime Resources Group Inc., at a mining rate of 275 tonnes per day, totalled 6113 kilograms (196 550 oz) of gold and 309 480 kilograms (9.95 million oz) of silver from 100 470 tonnes of ore milled. This equates to a gold equivalent production of 10 300 kilograms (331 300) ounces; total cash costs were US\$185 per gold equivalent ounce.

Eskay Creek is the sixth largest silver producer in the world, and one of the highest grade gold and silver deposits (\$1800 to \$2200 per tonne of ore) ever discovered in North America. Ore is being blended on site, trucked to load-out facilities at Stewart and Kitwanga, and shipped directly to smelters in Japan and Quebec, by ship and rail, respectively.

In 1996 operations continued to exceed expectations; the tonnage shipped is expected to be over 99 770 tonnes with a total production target of 11 800 kilograms (380 000 oz) of gold equivalent, a 13% increase from 1995. Cash costs through the first three quarters of 1996 are estimated at US\$170 per ounce gold equivalent, down from 1995. The increase in production is attributed to higher productivity, reduced underground development, and increased metal production (higher grades and metal prices). Silver production to the end of the third quarter had increased by 23.5% and gold by 5% from 1995. Reserves in the 21B deposit estimated by Prime at January 1, 1996 were 1 019 468 tonnes grading 64.46 g/t Au, 2859.4 g/t Ag, 0.86% Cu, 3.07% Pb and 5.43% Zn, good enough for a 10-year mine life.

In-mine (30 000m) and surface (6280m) exploration drilling during 1996 have added 302 938 tonnes containing 19 346 kilograms (622 000 Oz) of gold equivalent to Eskay Creek's ore reserves and resources (*i.e.* an 18.5% increase). These included proven and probable reserve additions of 220 000 tonnes grading 70.28 g/t Au in the 21B and 109 zones, and diluted geological resources of 82 537 tonnes grading 46.28 g/t Au equivalent in the NEX zone. A cut-off grade of 13.7 g/t Au equivalent was used. Although numerous drill intersections of high-grade

mineralization were encountered in the HW zone, no new resources have yet been calculated. These high-grade gold-silver zones, significantly base-metal enriched (up to 30% combined lead and zinc) and uniformly low in deleterious elements, occur at the base of the hangingwall andesite unit and are interpreted as the stratigraphic extension of the northeast end of the main 21B zone, with a 45° plunge to the north-northeast.

As a result of positive exploration and metallurgical results, Prime has decided to proceed with permitting and design of a mill facility to be located at the Eskay Creek minesite. The underground drilling program is continuing at the north end of the mine to extend and upgrade the NEX and HW zones.

Production during 1995 at the **QR** gold mine, at a average milling rate of 1100 tonnes per day, totalled 659 850 grams (21 215 oz) of gold from 194 318 tonnes of ore milled. Reserves estimated by Kinross Gold Corporation at January 1, 1996 were 1 287 239 tonnes grading 4.35 g/t Au. During 1996 Kinross increased the milling rate to 1200 tonnes per day, 400 tonnes over design capacity, in order to meet its production target of 1 244 000 grams (40 000 oz) of gold. Cash operating costs during the first three quarters of 1996 were US\$272 per ounce gold, slightly less than in 1995. Overall gold recovery is estimated at 91%, with 20 to 25% of the gold coming from gravity separation. Overall silver recovery is estimated at 30% or less. In 1996 mining took place in the Main zone; resources there are expected to be exhausted by August 1997. Early in 1996, Kinross mined approximately 32 000 tonnes (nearly double that which was previously outlined by drilling) at an estimated grade of 5.6 g/t Au from two benches in the West zone. This material has been stockpiled for winter milling. Mining in the West zone will resume later in 1997. The decline being driven parallel to the Midwest zone will enable the company to drill-test the grade continuity of the zone, prior to mining in early 1997. Surface exploration drilling was carried out in several areas on the property in 1996. Drilling on the margins of the West zone has been successful in outlining approximately 8 months of additional millfeed.

On April 30, 1996 Prime Resources Group Inc. purchased Cominco Ltd.'s 60% interest in the **Snip** gold mine for \$55 million, thereby giving Prime 100% ownership in the mine. Homestake Canada Inc. was appointed as operator of the mine under a managerial agreement similar to that for Prime's Eskay Creek mine. Since start-up in January, 1991, to the end of 1995, the Snip mine has produced 20 800 kilograms (669 000 oz) of gold at an average cost of US\$165 per

ounce gold. During 1995 the Snip mine produced 4000 kilograms (128 275 oz) of gold from 169 525 tonnes of ore milled. Mining was at a rate of 460 tonnes per day with a 12 g/t Au cut-off and operation costs are estimated at US\$175 per ounce gold. Proven and probable reserves estimated by Cominco at January 1, 1996 were 347 775 tonnes grading 26.74 g/t Au containing 9 250 kilograms (297 500 oz) of gold. In addition, possible reserve of 132 875 tonnes grading 23.66 g/t Au have been identified. During 1996 there were increases in production, depreciation and exploration expenditures. Lower productivity and lower production during the first half of the year were attributed to the mine's increasing reliance on narrow-vein mining methods and the uncertainty associated with the sale of the mine. In the second half, a refocusing of the mining effort has led to increased underground efficiencies which in conjunction with high grades, has put Snip back on track to achieve its 1996 production goals.

Cash costs during the first three quarters averaged US\$175/oz gold (cf. US\$174 in 1995). Recoveries for gold are approximately 35% by gravity circuit and 56% by flotation, for an overall 91% recovery. Concentrate has been shipped to the Premier mill near Stewart for further processing; however, Westmin has declined to accept shipments due to changing metallurgical characteristics in the concentrate resulting in a poorer gold recovery. Later in the year, concentrate was being "piggybacked" with Eskay Creek shipments to the Dowa smelter in Japan.

Exploration drilling of the Twin West (T-West) zone at 20m spacing gave inconclusive results. Homestake Canada plans to submit a mine plan to the British Columbia government to extract 36 000 tonnes of ore from this narrow (up to 1 meter) vein system which lies immediately to the north and west of the tailings pond. It hopes to be able to mine a high-grade ore shoot with a cut-off grade of 12 to 15 g/t Au.

The **Highland Valley Copper** mine, a partnership among Cominco Ltd. (50%), Rio Algom Limited (33.6%), Teck Corporation (13.9%) and Highmont Mining Company (2.5%), milled 45 521 000 tonnes during 1995 at an average daily throughput of 124 715 tonnes. Some 270 000 tonnes of ore and waste are mined daily. Production totalled 157 980 tonnes of copper contained in concentrate, 58 790 kilograms (1.89 million oz) of silver, 396.5 kilograms (12 745 oz) of gold and 1566.4 tonnes of molybdenum. Annual capital expenditures at the mine average \$25 to \$30 million while revenues amount to approximately \$400 million per annum. The mine is one of the largest operations in the world, ranking third on the basis of tonnage milled,

and employs about 1100 people. Reserves estimated by the partnership, as of January 1, 1996, were 504 million tonnes grading 0.42% Cu, 4.8 g/t Ag, 0.032 g/t Au and 0.0076% Mo. Currently, 95% of millfeed is from the Valley orebody, 5% from Lornex. Mining cut-off grade averaged 0.25% copper equivalent (or approximately 0.2% Cu). In order to reach the credit limit for gold production, small amounts of gold from the Snip mine were added to the concentrate. The molybdenum content can account for up to 1% to 3% of the profit with molybdenum concentrate grades between 45% to 55% Mo. To facilitate mining in the Valley pit, in-pit crushers (biggest in the world) were re-positioned as the east and northeast walls of the pit were being pushed back as part of the long-term expansion plan. Current mine plans call for mining another 200 m in depth in the Valley pit to the year 2008. In addition, the partnership may consider mining the remaining 120 million tonnes grading 0.33% Cu estimated to exist in the Lornex pit. Exploration in 1996 consisted of confirming mineralization in the JA orebody, which is covered by extensive overburden, and follow-up drill testing of geophysical anomalies in the east wall of the Valley pit and easterly across the Lornex fault. Also, exploration in 1995 identified a possible resource of 200 million tonnes grading 0.4% Cu at depth, below the current designed depth of the Valley pit. This resource was further examined in 1996 and resulted in the identification of an indicated resource of 350 million tonnes grading 0.384% Cu, which could extend the life of the operation by about 7.5 years.

During 1995 the Westmin Resources Limited **Myra Falls** mine produced 21 770 tonnes of copper, 26 780 tonnes of zinc, 17 000 kilograms (546 570 oz) of silver and 819 kilograms (26 330 oz) of gold from 1 197 000 tonnes of ore, milled at a daily throughput of 3650 tonnes. Proven and probable mineable reserves estimated by the company as of January 1, 1996 were 11 150 400 tonnes grading 1.6% Cu, 0.3% Pb, 6.1% Zn, 1.5 g/t Au and 27.5 g/t Ag. Geological reserves in the Battle zone, which is currently being developed and mined, are 2.5 million tonnes grading 2.0% Cu, 10.6% Zn, 1.0 g/t Au and 20.3 g/t Ag.

There are two other high-grade zinc zones closely associated with the Battle: The Gopher and Gnu, which together total about 700 000 tonnes. Exploration underground in 1996 increased the size of the Gopher zone substantially, while providing development ore to the mill. Westmin continued to increase its zinc production, largely from the Gopher/Battle zones, while maintaining historic levels of copper production, largely from the H-W deposit. It hopes to further increase zinc production once full production is achieved from the Battle zone and the Main 24 Level haulage route is fully

operational. Westmin also completed construction of a cross-cut in the Price Mine area, designed to provide access for an additional drilling program on the Trumpeter zone in the fall or winter. Westmin postponed a deep drilling program (2-3 holes) on Phillips Ridge designed to test stratigraphy in the northwestern part of the property where it hopes to be able to gain access via a new 750m cross-cut in the Lynx underground mine to the newly-discovered Marshall zone.

At the Gibraltar Mines Limited **Gibraltar** (McLeese Lake) mine, production during 1995 totalled 27 795 tonnes of copper in concentrate and 2600 tonnes of cathode copper and 30.4 tonnes of molybdenum, from milling of 13 852 610 tonnes of ore at a daily throughput of 37 950 tonnes. Reserves estimated by the company at January 1, 1996 were 162 302 200 tonnes grading 0.297% Cu and 0.009% Mo. The mine life is estimated at 12 years, not including resources in the Gib North, GM or Sawmill zones. Current mining is from Phase 3 of the Gibraltar East pit; the cut-off milling grade is 0.2% Cu. This operation with 275 employees, is highly efficient and one of the lowest grade (if not the lowest) copper mines in North America. Total operating costs for 1996 are estimated at US\$0.93 per pound copper. The molybdenum circuit was also in operation in 1996. The SX-EW plant accounts for approximately one seventh of copper production, with four active dumps providing the copper solution. Exploration in 1996 consisted of a small (2440m) diamond drilling program on the Sawmill skarn zone to the south of the mine, plus bulk sampling and metallurgical testing of surface oxide material from the Connector zone which is expected to add at least another 1.2 million tonnes of reserves to the mine. Over the next few years, an aggressive exploration and development program is planned, including the Pollyana pit expansion to the north-northeast to develop reserves in the GM zone and pit expansion in the Granite Lake zone. In mid-October, Westmin Resources Ltd., through its subsidiary WRL Acquisition Corp., effectively took over control of Gibraltar Mines Ltd., including the McLeese Lake mine.

During 1995 the Princeton Mining Corporation **Similco (Copper Mountain)** mine produced <N>17 113 tonnes of copper, 736.5 kilograms (23 680 oz) of gold, and 2970 kilograms (95 565 oz) of silver from 7 371 190 tonnes of ore milled at a daily throughput of 19 140 tonnes. Reserves estimated by the company at January 1, 1996 were 123 742 000 tonnes grading 0.393 % Cu, 0.155 g/t Au and 1.576 g/t Ag. During 1996 mining of approximately 14 million tonnes with an average grade of 0.32% Cu occurred in the Ingerbelle East pit; mining ceased in early November. Phase 2

expansion of the Ingerbelle East zone, involving a push back of the West wall and mining of a potential 20 million tonnes of ore eastwards down towards the Similkameen River, was cancelled. During 1996 Princeton conducted an aggressive three phase, diamond drilling (12 190m) exploration program on the east side of the Similkameen River, designed to establish sufficient low-cost reserves (*i.e.* in excess of 100 million tonnes grading 0.45% Cu at a strip ratio of 1.5:1 or less) for a 10-year mine plan. The primary (Phase I) target area, called the SP zone, encompasses existing reserves in the formerly producing Pit 2 and Pit 3 areas as well as extensions of known mineralization that occur between the two pits. Drilling also tested the Oronoco zone, which is located along the Virginia-Alabama mineralized trend, 910 metres to the west of the Alabama zone. Initial results from both the SP and Oronoco target areas were encouraging. Also, following some positive results from Phase I drilling on the Alabama zone, a Phase III drilling program will test for continuity of higher grade zones.

The Homestake Canada Inc. **Nickel Plate** open pit gold mine produced 2842 kilograms (91 365 oz) of gold from 1 461 780 tonnes of ore milled in 1995, at a daily throughput of 3635 tonnes. Total cash costs were (CDN \$379 per ounce gold). Reserves estimated by the company at January 1, 1996 were 696 655 tonnes grading 2.84 g/t Au. Mining, at a cut-off of 1.2 g/t Au, ceased in mid-July in the North pit. The entire operation over the past 9 years has produced approximately 24 880 kilograms (800 000 oz) of gold. Although the open-pit mineable reserves were exhausted, mineralization continues down dip to the west on to adjacent properties; future development might come from a decline from the bottom of the North pit on the north wall.

Production at the Westmin Resources Limited **Premier** gold mine during 1995 totalled 580 kilograms (18 665 oz) of gold and 6235 kilograms (200 495 oz) of silver from 179 500 tonnes of ore milled at a daily throughput of 490 tonnes. In addition, custom treatment of Snip mine concentrates during early 1996, yielded additional gold and silver. Later in the year, Premier ceased treatment of Snip concentrate. Reserves estimated by the company at January 1, 1996 were 260 000 tonnes grading 4.65 g/t Au and 68.0 g/t Ag. During 1996 millfeed came from the Glory Hole and other underground areas. Underground mining was suspended on April 12, 1996 due to poor grades in the developed zones and dwindling reserves. Fifty of the seventy-five employees were laid off. A compilation in early 1996 by the company identified a possible underground resource of approximately 1 million tonnes grading 7.9 g/t Au. Metallurgical testing examined the feasibility of producing a zinc concentrate. Westmin also conducted

an aggressive, two-phase exploration surface and underground diamond drilling program, estimated to total approximately 12 800m, testing for mineralization between the No. 4 and No. 6 levels of the mine and also for deeper mineralization in the Martha Ellen zone on the Big Missouri deposit to the north. The overall target is to identify enough reserves for three years of production. Preliminary results are very encouraging; a new mine plan is being developed with the potential for re-opening in the near future.

At the Afton Operating Corporation **Ajax** copper-gold mine production in 1995 from the Ajax East pit totalled 10 586 tonnes of copper, 747.5 kilograms (24 033 oz) of gold, and 1450 kilograms (46 620 oz) of silver from 3 110 000 tonnes milled at a daily throughput of 8770 tonnes. Reserves for the Ajax West deposit estimated by the company at January 1, 1996 were 3 613 700 tonnes grading 0.48% Cu, 0.38 g/t Au and 0.86 g/t Ag. During 1996 mining took place in the Ajax West pit; much of the Ajax East pit has been backfilled with waste from the West pit. Afton has decided to close the mine in June 1997 due to higher operating costs and lower metal prices; layoffs began in December 1996. Teck Corporation carried out a large exploration program over the entire Iron Mask Batholith in 1996, including drilling programs on the Rainbow, Galaxy, Audra (between DM and Crescent zones), Coquihala East and West (south-southeast of Pothook zone), Supergene (north of Afton pit), and Galaxy North. (*see* Advanced Exploration and Development Projects). In addition, an estimated 3 million tonnes grading 1.5% Cu exists in the southwest wall of the Afton pit.

At the **Endako** molybdenum mine, Placer Dome Canada Limited produced 6536 tonnes of molybdenum in 1995, from 10 430 000 tonnes of ore milled at a daily throughput of 29 100 tonnes. Proven and probable ore reserves estimated by the company were 104 843 000 tonnes grading 0.077% Mo at January 1, 1996. Mining in 1996 took place in the Main zone pit; mine life is estimated at 10 years at an average grade of 0.126% MoS_{2-CD} and a cut-off of 0.07% MoS_{2-CD}. A relatively small (6-hole) diamond drilling program was also carried out; a much larger program is planned to test much of the property in 1997. Also, the mine supported a thesis study at the University of Alberta, designed to examine the structural controls of the ore zones and the temperatures of formation of the alteration and ore minerals.

Cominco Ltd. production at the **Sullivan** underground zinc-lead-silver mine in 1995 was 58 356 tonnes of lead, 113 024 tonnes of zinc and 21 118 kilograms (678 970 oz) of silver, from 1 616 000 tonnes

of ore milled at a daily throughput of 6900 tonnes. Zinc concentrate production was the highest level achieved in the last 30. Reserves estimated by the company at January 31, 1996 were 11 435 200 tonnes grading 25.0 g/t Ag, 4.5% Pb and 8.0% Zn, sufficient for about another five years. Sullivan supplies 40% of Trail's zinc concentrates and 80% of its lead concentrates. Since 1923 when the concentrator started treating ore, approximately 140 million tonnes of ore grading 6.2% Pb and 5.6% Zn have been milled. In total, about 13.6 million tonnes of zinc concentrates (at an average grade of 48% Zn and 68.6 g/t Ag) and 10.9 million tonnes of lead concentrates (grading 66% Pb and 720 g/t Ag) have been produced and sold to Trail. At today's metal prices, that represents an estimated value of production of about \$6 billion.

In 1996 Cominco completed a deep (2600m) diamond drill hole in the Mark Creek area northwest of the mine to further evaluate a dislocated piece of the Sullivan deposit. It also conducted down-hole geophysics and a surface UTEM geophysical survey.

At the **Table Mountain**, Cusac Gold Mines Ltd. produced 411 kilograms (13 220 oz) of gold in 1995 from approximately 21 500 tonnes of ore averaging 19.2 g/t Au, milled intermittently at a daily throughput of 275 tonnes. Mining during 1996 came mainly from the Lily vein, which forms part of the northeast extension of the Michelle high-grade zone, where a decline was driven to the 13 level. Further exploration/development drilling continued to test the vein for additional reserves, especially to the east and to depth. This vein is the richest vein discovered on the property, with widths up to 3.66m and grades in excess of 68.6 g/t Au over a strike length of approximately 30m. Milling was carried out intermittently at a daily rate of between 60 and 70 tonnes, with an estimated head grade of 51.4 g/t Au. A limited amount of mining was also carried out on the previously-mined Vollaug vein; surface drilling also intersected significant values in 9 holes. The vein is estimated to contain proven, probable and possible reserves of 39 360 tonnes grading 15.43 g/t Au, raising total reserves, as of October 1, 1996, to 131 100 tonnes grading 12.69 g/t Au. Additional underground drilling continues on both the Lily and Vollaug veins. The company's target production for 1996 was approximately 653 kilograms (21 000 oz) of gold at a cash cost of US\$217 per ounce gold. Elsewhere on the property, an 1800m surface diamond drilling program tested a number of other targets. Underground drilling led to the discovery of a new vein, the Melissa vein, located to the north of the Michelle zone. This new vein has been delineated by drilling over a 70m strike length and 20m downdip. Drifting towards this new vein is in progress and mining

is expected to start in early 1997. Cusac plans completion of the 10-portal in 1997, a major underground development project to improve access to the ore zones and, ultimately, to increase production.

At the **Goldstream** mine, Bethlehem Resources Corporation produced 10 220 tonnes of copper and 1043 tonnes of zinc from 302 835 tonnes of ore at a daily throughput of 1100 tonnes. Reserves estimated by the company were approximately 22 000 tonnes grading 3.5% Cu and 2.15% Zn as of January 1, 1996. Mining and milling operations were terminated on January 31, 1996. During the mine's 4.5 year life, 1.8 million tonnes were milled yielding 65 600 tonnes of copper and 28 635 tonnes of zinc in concentrate. In March 1996, Imperial Metals Corporation's wholly owned subsidiary Bethlehem Resource (1966) Corporation entered into a purchase agreement with Goldnev Resources Ltd. to increase its interest in the mine, production facilities and tailings dam disposal area from 50% to 100%. Most of the Goldstream facility will be maintained on a stand-by-basis, pending the outcome of exploration programs on properties in the area of the Goldstream mine (*e.g.* Rain and Cottonbelt; *i.e.* custom milling potential).

The **Island Copper** mine produced 38 777 tonnes of copper, 1400 tonnes of molybdenum, 10 900 kilograms (350 800 oz) of silver and 661 100 grams (21 255 oz) of gold from 16 474 700 tonnes of ore milled at a daily throughput of 45 510 tonnes in 1995. Mining and milling operations ceased at the end of 1995. During its operating life from 1971 to 1995 inclusive, the mine produced concentrate yielding approximately 1.27 million tonnes of copper, 34 214 kilograms (1.1 million oz) of gold 360 800 kilograms (11.6 million oz) of silver, 31 560 tonnes of molybdenum and 28.2 tonnes of rhenium. An estimated \$900 million was paid out in salaries and in excess of \$3 billion was added to the provincial economy. Mine reclamation in May 1996 involved the flooding of the pit, which had reached a maximum depth of 402 metres below sea level (the lowest man-made pit open to air on the earth's surface), to create a lake.

COAL MINES

Total clean coal production in 1996 is estimated at about 26 million tonnes, approximately 23.1 million tonnes metallurgical and 2.7 million tonnes thermal, for a total forecast value of approximately \$1.13 billion. This represents an increase of approximately \$144 million (12%) over 1995. Most of the major plant expansions are complete so that the total capital expenditure at the mines is down, however, with equipment replacement it is still estimated at in excess

of \$20 million for all the mines. Most mines are fine tuning long-term mine plans and two mines in the southeast (Line Creek and Greenhills) conducted exploration programs, outside their mine leases, aimed at better defining long-term reserves, which at the moment are not part of their mining plans. Total expenditure on exploration and development at existing coal mines is forecast to be approximately \$3.6 million in 1996, a slight decrease from 1995.

At the **Quinsam** mine on Vancouver Island, Quinsam Coal Corporation reached the design capacity of 100 000 tonnes of clean coal per month, one year ahead of schedule, and is on target to produce 1 million tonnes of clean coal in 1996. The company plans to further increase production to about 1.2 million tonnes annually or 17% above design capacity. This would almost double the output in 1996, with approximately 225 employees. Mining is from five sections underground. The company bulk sampled and began developing the "242" block at the south end of the coal lease. It also drilled the "4S" area for structural control ahead of development in the 2N area for additional resources. The "4S" and "242" blocks are providing millfeed; the "2S" block closed in late 1996. Total onsite exploration expenditures are estimated at \$210 000. The construction at the Middle Point loadout, north of Campbell River, is finished and the facility can now store 12 000 tonnes of coal and load at the rate of 1800 tonnes per hour. Quinsam also completed a major exploration program on the Tsable River property (*see* Advanced Exploration).

The **Fording River** mine, operated by Fording Coal Corporation, expects to ship approximately 7.3 million tonnes in 1996, a small increase over the 1995 production of 7 million tonnes. Major drilling programs on the mine lease were completed at Castle Mountain (10 holes totalling 6000 metres) and Henretta Ridge (30 holes totalling 4580 metres). Total exploration expenditures are estimated at \$1.2 million. At the **Greenhills** mine, Fording Coal expected to sell 4.2 million tonnes of coal in 1996, of which approximately 500 000 tonnes was thermal coal. This production was achieved with a workforce of approximately 360 persons, making the Greenhills mine one of the most productive surface coal mines in the world. The 1995 production was 3.8 million tonnes; 1997 production is projected to increase to 4.3 million tonnes. Exploration programs were completed on the mine lease and in areas adjacent to the lease. In-pit drilling (65 holes totalling 8500 metres) was estimated to have cost approximately \$350 000. Pit development work on the mine lease cost an additional \$60 000 (4 holes totalling 1200 metres). Two, off-site exploration drilling programs were conducted in the Burnt Ridge Extension

area (Crow area) (16 holes totalling 2900 metres) at an estimated cost of \$200 000, and on Burnt Ridge (16 holes totalling 5000 metres), costing \$300 000. Mine plans call for the development of the West Spoil area for 12 years of mine life and the development of the Crow area to replace the Raven pit, where reserves will be exhausted in late 1997. The British Columbia Geological Survey Branch is conducting a study of the distribution of phosphorous, germanium, and selenium, at the Fording River and Greenhills mines.

Coal Mountain Operations, owned by Fording Coal Corporation, has increased production from 1.2 to 2.3 million tonnes and hopes to further increase production to 2.5 million tonnes in 1997. Manpower has increased to about 180 persons. Production is split approximately into 20% thermal, 40% PCI and 40% weak coking coal. Most of the plant expansion construction has been completed, although work is continuing on a new breaker site. Exploration continued in the pit 7 area (24 holes), south of the present pits, and in the Middle Mountain area (3 holes) to the north. Exploration drilling of approximately 6000 metres is estimated to have cost \$350 000.

At the **Line Creek** mine, Line Creek Resources Ltd. expects to ship 2.6 million tonnes of metallurgical coal and 740 000 tonnes of thermal coal in 1996; production in 1997 is planned to be about the same level. The access road to the new mining area (Horseshoe Ridge) was completed and mining of a small tonnage of thermal coal was scheduled to commence in late 1996. Construction of a 10-kilometre long conveyor was completed and it is undergoing commissioning trials.

At the **Elkview** mine, Teck Corporation increased production from 2.8 to 3.1 million tonnes; furthermore, it plans to increase production to 3.2 million tonnes in 1997. Most of the coal produced is metallurgical, although two varieties of weak coking coal are also sold. Mining is planned to start in the Natal Ridge area (*i.e.* large highwall pushback) in 1997 and mine plans are being developed for the Baldy Ridge area. Exploration associated with the new mine plans is estimated to have cost \$400 000, including the drilling of 80 holes totalling over 10 000 metres.

In the northeast, the **Bullmoose** mine (Teck Corporation, 60.9%; Rio Algom Limited, 29.1%; Nissho Iwai Coal Development (Canada) Ltd., 10%) is on target to ship 2 million tonnes at \$94 per tonne. A small exploration program, consisting of 30 drill holes totalling 3000 metres at a cost of \$75 000, was conducted in 1996. Three new 190-tonne trucks were purchased and will be commissioned before the end of the year. Existing data on the West Fork area is being

re-evaluated in preparation for future exploration in this area which will probably supply coal past 1998.

The **Quintette** mine, operated by Quintette Coal Limited and managed by Teck Corporation, expects to ship 4.3 million tonnes of metallurgical coal in 1996 at \$89 per tonne. The company has negotiated an extension of its contract with Japanese steel mills by 6 months to September 30, 1998. The Shikano pit will be mined out over the next year. Development work is proceeding in the Babcock area and \$500 000 was spent on engineering studies. The company plans to mine about 500 000 tonnes from the Little Windy pit (Babcock Ridge) and continue development of other pits in the area in 1997. Three new 240-tonne trucks have been purchased to help achieve this target.

INDUSTRIAL MINERALS MINES

British Columbia is producing a wide variety of industrial minerals and interest is on a steady increase. There are nine major mines and more than thirty smaller quarries. These operations are located mainly in the southern half of the province, close to existing infrastructure. The most economically significant industrial minerals produced are sulphur, magnesite, gypsum, white calcium carbonate, silica, barite, limestone and construction aggregate. The lesser quantities produced include jade, diatomite, magnetite, dolomite, dimension stone, pyrophyllite, volcanic cinder, clay, fuller's earth and zeolites. The annual value of production is in the order of \$60 million, with structural minerals (principally sand and gravel) accounting for another \$375 million.

Sulphur, which is a by-product of natural gas, is produced at five processing plants in the northeast part of the province. Some sulphur is also produced at the Trail smelter. Total annual production in British Columbia is between 600 000 and 650 000 tonnes.

In the Rocky Mountains, Westroc Industries Limited is producing approximately 460 000 tonnes of **gypsum** from its **Elkhorn 1** and **Elkhorn 11** quarries. After a two-year hiatus, the new owner (Georgia Pacific) of the **Canal Flats** operation began operating the Coyote Creek quarry. Its 100 000 tonne captive market is supplied from a stockpile, usually mined in one year of a three-year program.

Baymag Mines Company Limited continued to mine **magnesite** at **Mount Brussilof** at an annual rate of 180 000 tonnes. The magnesite is processed in Exshaw, Alberta into 15 000 tonnes of fused product and the remaining part as caustic magnesia. The company is gearing to shift its production from an existing rotary kiln into a newly-built shaft kiln. This

will not only increase efficiency, but will also significantly increase the processing capacity.

The **Mount Moberly and Horse Creek** mines in the Golden area account for all high-grade **silica** production in British Columbia. Mountain Minerals Company Ltd. is producing approximately 140 000 tonnes annually at Moberly, for shipment to Springfield, Oregon, Lavington, B.C. and other destinations. Nugget Contracting Ltd. is producing 70 000 tonnes annually of which 50 000 tonnes is shipped to Wenatchee, Washington.

Limestone is processed in British Columbia by three cement plants and two lime plants. The majority of pulp and paper mills produce their own lime from nearby limestone quarries. The largest production centre is **Texada Island**, where two quarries, the **Gillies Bay (Holnam West)** and **Blubber Bay (Ashgrove Cement)**, ship some 5 million tonnes annually to customers in British Columbia, Alaska, Washington, Oregon and California. About 1 million tonnes of waste rock is sold annually from Texada Island as construction aggregate. The Continental Lime Ltd. **Pavilion Lake** plant produces up to 200 000 tonnes of lime per year from limestone quarried on the site, and the **Kamloops** cement plant of Lafarge Canada Inc. is producing up to 200 000 tonnes of cement annually from locally-quarried limestone. In Richmond, Lafarges' proposed \$130 million upgrade to its cement plant has gone through the Environmental Assessment Office review process; approval was recommended. The upgrade will allow the plant to produce 1.0 million tonnes of cement using limestone from Texada Island, coal from Quinsam coal mine and silica mainly from Fraser River sands. Near Prince George, Kode-Jerrat Quarries Ltd. at **Giscome** sells about 30 000 tonnes of limestone to pulp mills in the region. **White calcium carbonate** is produced from deposits on **Texada Island** (Vananda and Gillies Bay), **Benson Lake** on Vancouver Island and **Lost Creek** near Salmo at a rate of 160 000 tonnes annually. A small limestone producer at **Dahl Lake**, west of Prince George, has in recent years been processing old waste rock into decorative aggregate at the rate of some 20 000 tonnes per year.

Mountain Minerals Ltd. operates the **Parson** mine, British Columbia's only **barite** producer. The reserves are almost depleted; the mine may close by the year 2000, and the company is looking for a new source. The barite is being processed in Lethbridge, Alberta into drilling mud and fillers.

Clayburn Industries Ltd. of Abbotsford is processing locally-mined **fireclay** from Sumas Mountain, **diatomite** from Quesnel and **pyrophyllite** from Princeton into a variety of refractory bricks and

castable refractory products. Western Industrial Clay Products Ltd. in Kamloops supplies approximately half of the kitty litter market (and other domestic and industrial absorbents) in Western Canada, principally from its **Red Lake** property near Kamloops. Small quantities of **ornamental and facing brick** and **flueline pipe** are produced by Sumas Clay Products Ltd. operated by the Sumas Band near Abbotsford.

Granite and marble are produced by several companies. Stone-processing plants are operated by Westcoast Granite Manufacturing Inc. in Delta, Margranite Industries Ltd. in Surrey, Matrix Marble Corporation in Duncan and Garibaldi Granite Group in Squamish. Margranite is processing nine granite varieties from five quarry sites, Garibaldi Granite has three granite varieties from two quarry sites and Matrix Marble has two quarry sites with three marble varieties. San Pedro Stone commenced production of black granite blocks from a quarry near Grand Forks for export to Korea; the first shipment left Vancouver on January 30, 1996. Full quarry permits have been received and commercial development is scheduled for 1997. Three additional discoveries in the area include: 1) Imperial No. 1 (greyish-pink granite); 2) Gord No. 1 (blue/pink granite); and 3) Pedro (dark-green granite). Pender Capital Corporation and its 50% owned subsidiary Garibaldi Granite Group constructed a 12 500 square foot production facility in Squamish to supply dimension stone to international markets. The automated equipment began to produce finished products from raw materials extracted from the company's three quarries beginning in August. Pre-marketing efforts have shown promising results. Other active quarry sites include: Tsitika Stone Industries on northern Vancouver Island (grey granite), Granite Creations, north of Harrison Hot Springs (black granite) and Adera Natural Stone Supplies Ltd. on Granite Island near Sechelt. Franz Capital Corporation Ltd. has been delivering stone products from its **Kingfisher marble** quarry near Enderby to landscape and brick retail businesses and construction sites in British Columbia and Alberta. Products manufactured and stockpiled include split stone bricks and marble rock and chips.

Flagstone has been produced traditionally by Revelstoke Flagstone Quarries and Begbie Flagstone Ltd., together producing approximately 200 tonnes of mica schist flagstone. Kootenay Stone Centre in Salmo is producing about 4000 tonnes of **quartzite flagstone**. In 1996 two small local companies started to produce

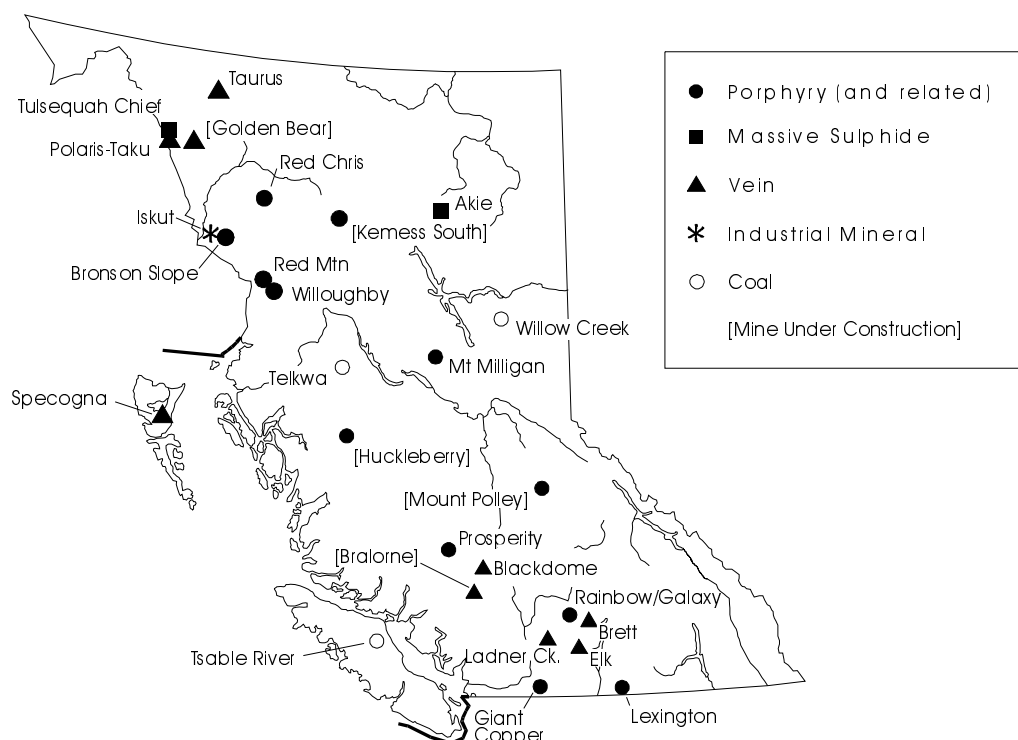


Figure 8. Advanced exploration and development projects in British Columbia - 1996.

slate on a small scale near Port Renfrew on Vancouver Island.

Dolomite is quarried by IMASCO Minerals Ltd. at Crawford Bay on Kootenay Lake and by Mighty White Dolomite Ltd. near Rock Creek. Dolomite is used for soil conditioning, white ornamental aggregate, for stucco and roofing, fine aggregate, and synthetic marble products.

Jade production is concentrated in the Kutcho Creek area principally at the **Serpentine Lake** property being mined by Polar Gemstones Ltd. A small quantity of jade is also recovered from the old Cassiar Asbestos mine waste dumps by Jedway Enterprises. Jade West Resources Ltd. operates a jade processing facility in Surrey.

Canada Pumice Corporation is producing red **volcanic cinder** from its **Nazko** quarry west of Quesnel, at a rate of 40 tonnes per day. On a smaller scale, Great Pacific Pumice Ltd. started shipping **pumice** from its **Pum** property on Mount Meager, north of Pemberton.

TAILINGS

Candorado Operating Company Limited completed mining of the **Mascot Gold** tailings in 1995.

Production totalled 94 kilograms (3000 oz) of gold and 10 kilograms (320 oz) of silver from 42 640 tonnes processed. Processing of tailings was completed in October 1996; reclamation is in progress. M. Seven Industries Inc. continues to produce about 60 000 tonnes per year of magnetite by processing the **Craigmont** tailings. The company is supplying most coal mines in Western Canada.

ADVANCED EXPLORATION AND DEVELOPMENT PROJECTS

METALS

It is estimated that about 73% of expenditures in 1996 has been for advanced exploration and development projects, including bulk sampling and environmental programs. A number of projects advanced to the development or bulk sampling stage. Three large porphyry deposits (**Kemess South**, **Huckleberry** and **Mount Polley**) are in the construction phase, with combined estimated capital costs totalling approximately \$650 million. The three mines, scheduled to be in production in 1998, collectively will create approximately 700 new,

TABLE 3
NEW MINES, CLOSURES, DEVELOPMENT AND
ADVANCED EXPLORATION PROJECTS

Company Name	Project Name	Commodity	Estimated Tonnes (000s)	Estimated Grade	Reference
Development					
Imperial Metals Corp.	Mount Polley	Cu, Au	82 300	0.3% Cu, 0.417 g/t Au	Imperial Metals, 1996
Royal Oak Mines Inc.	Kemess South	Cu, Au	200 400	0.22% Cu, 0.63 g/t Au	Royal Oak, 1996
Huckleberry Mines Ltd.	Huckleberry Main Zone	Cu	26 820	0.48% Cu, 0.07 g/t Au, 2.17 g/t Ag, 0.013% Mo	Huckleberry, 1995
	East Zone		72 710	0.52% Cu, 0.06 g/t Au, 3.1 g/t Ag, 0.014% Mo	
Polar Res. Ltd.	Serpentine Lk.	Jade			
Closures					
Bethlehem Resources Corporation	Goldstream	Cu, Zn, Ag			
Homestake Canada Inc.	Nickel Plate	Au, Ag			
Westmin Resources Limited	Premier	Au, Ag			
Candorado	Hedley Tailings	Au			
Similco Mines Ltd.	Similco	Cu,Au			
Advanced Exploration					
Porphyry (and related) Deposits					
Taseko Mines Ltd.	Prosperity (Fish Lake)	Cu, Au	675 000	0.236% Cu, 0.435 g/t Au	Taseko Mines, 1995
Placer Dome Inc.	Mt. Milligan	Cu, Au	298 400	0.22% Cu, 0.45 g/t Au	Placer Dome, 1993
American Bullion Minerals Ltd.	Red Chris	Cu, Au	494 000	0.323% Cu, 0.254g/t Au	Amer. Bull., 1995
Princeton Mining	Similco - all zones	Cu, Au	123 742	0.393% Cu, 0.155 g/t Au, 1.576 g/t Ag.	Princeton, 1996
	- Ingerbelle(Phase 2)		7 800	0.31% Cu	
	- Alabama		26 300	0.352% Cu, 0.17g/t Au.	
	- Oriole		2 630	0.44% Cu	
	- Pit2		35 400	0.33% Cu, 0.12 g/t Au.	
	- Pit3		53 500	0.48% Cu	
Gibraltar Mines Ltd.	Gibraltar (total)	Cu	162 300	0.297% Cu, 0.009% Mo.	Gibraltar, 1995
	- Gib North (est.)		40 000	0.4% Cu	
	- Pollyanna (CM)		48 000	0.32% Cu, 0.009% Mo.	

British Columbia

Gibraltar Mines Ltd cont.	- Granite Lake		73 765	0.305% Cu	
	- Connector		1 100	0.372% Cu (leachable)	
	- Gibraltar East		44 625	0.281% Cu, 0.008% Mo.	
Royal Oak Mines Inc.	Red Mountain	Au, Ag	1 920	9.8 g/t Au	Royal Oak, 1996
International Skyline Gold Corp.	Bronson Slope	Cu, Au, Ag	97 920	0.57 g/t Au, 0.2 % Cu, 2.65 g/t Ag	International Skyline, 1996
Britannia Gold Corp./ Bren-Mar Res. Ltd.	Lexington	Cu, Au	162	8.9 g/t Au 0.96% Cu	Bren-Mar, 1995
Getchell Res./ Teck Corp.	Galaxy	Cu, Au	3200	0.65% Cu,0.34 g/t Au	Getchell, 1995
Getchell Res./Teck Corp.	Rainbow (Kamloops)	Cu, Au	14 100	0.5% Cu	Teck, 1995
Imperial Metals Corp.	Giant Copper (AM)	Cu, Au	29 500	0.65% Cu, 0.38 g/t Au, 12 .34 g/t Ag.	Imperial Metals, 1995

Massive Sulphide Deposits

Prime Res. Gp. Inc.	Eskay Creek	Au, Ag			Prime, 1996
	- 21B (prov. + prob.)		97	130.6 g/t Au equiv.	
	- 109 (prov.+ prob.)		123.3	22.97 g/t Au equiv.	
	- NEX (dil. geol.)		82.5	46.28 g/t Au equiv.	
Redfern Res. Ltd.	Tulsequah Chief/ Big Bull	Cu, Pb, Zn, Au, Ag	7910	1.27% Cu, 1.18% Pb 6.35 % Zn, 2.42 g/t Au, 100.9 g/t Ag	Redfern, 1995
Inmet Mining Corp./ Ecstall Mining Corp.	Akie	Zn, Pb, Ag	12	8.6 % Zn, 1.5 % Pb, 17.1 g/t Ag.	Inmet, 1996

Vein Deposits

Wheaton River Minerals Ltd./ North American Minerals Ltd.	Golden Bear	Au			Wheaton R., 1996
	- Ursa	Au	511	7.0 g/t Au	
	- Kodiak A	Au	824	3.3 g/t Au	
	- Kodiak B	Au	278	8.6 g/t Au	
	- Kodiak C	Au	276	7.8 g/t Au	
	- East Low Grade Stockpile	Au	2.45	1.3 g/t Au	
	- Grizzly	Au	153	20.5 g/t Au	
Bralorne-Pioneer Gold Mines Ltd./ Avino Mines and Res. Ltd.	Bralorne	Au,Ag			Bralorne-Pioneer, 1995
	Above 1000 level		432.5	10.6 g/t Au	
	Below 1000 level		673	8.2 g/t Au	
	51 vein		110.7	12.7 g/t Au	
	Loco veins		363	17.14 g/t Au	
Huntington Res. Ltd.	Brett	Au			Huntington, 1993
	Bonanza Zone		12	39.1g/t Au	
	R.W. vein				
Golden Angus Mines Ltd..	Polaris-Taku	Au	3170	14.1 g/t Au	Canarc, 1995
Athabaska Gold Res. Ltd.	Ladner Creek - Idaho	Au	1630	4.46 g/t Au	Athabaska, 1996
	- Tailings	Au	660	1.75 g/t Au	
Fairfield Minerals Ltd.	Elk (Siwash North)	Au	121	25.4g/t Au, 35.3g/t Ag	Fairfield, 1996

Hera Res. Inc./ International Taurus Res. Ltd./ Cusac Industries Ltd.	Taurus 88 Hill Zone (inferred) (indicated)	Au, Ag	13 725 25 134	1.01 g/t Au 0.67 g/t Au	Hera, 1995
Misty Mountain Gold Ltd.	Specogna (Cinola)	Au, Ag	31 300	2.2 g/t Au	Misty Mtn., 1995
Claimstaker Res. Ltd.	Blackdome	Au, Ag	159.6	16.11 g/t Au, 37.0 g/t Ag	Claimstaker, 1995
Prime Resources Gp.Inc.	Snip -Twin West	Au	?	?	Prime, 1996
Westmin Res. Ltd.	Premier (proven + probable) (possible)	Au,Ag	261 151	7.9 g/t Au, 35.3 g/t Ag. 8.6 g/t Au, 30.9 g/t Ag.	Westmin, 1996
Cusac Gold Mines Ltd.	Table Mountain - Vollaug	Au	39.4	15.43 g/t Au	Cusac, 1996
Coal and Industrial Mineral Deposits					
Mountain Minerals Co. Ltd.	Ranchlands	zeolite			Mountain Minerals, 1995
Canmark Int'l Res. Ltd.	Sunday Creek	zeolite			Canmark, 1995
Highland Talc Minerals Ltd.	Goldbridge	talc			Highland Talc, 1995
Okanagan Opal Inc.	Klinker	fire opal			Okanagan, 1995
Quinto Mining Corp. Ltd.	Lumby	graphite, sericite			Quinto, 1995
New Global Res. Ltd.	Monteith Bay	silica, pyrophyllite			New Global, 1995
Super Twins Res. Ltd.	Isk	wollastonite	2000	80%	Super Twins, 1995
Manalta Coal Ltd.	Telkwa	coal	46 000	thermal	Manalta, 1996
Globaltex Industries Ltd.	Willow Creek	coal		thermal	Globaltex, 1995
Quinsam Coal Corp.	Tsable R.	coal	38 478	thermal	Quinsam, 1996
Line Creek Res.	Mount Michael	coal			Line Ck., 1996
IMP Ind.Min. Park	Black Crystal	graphite	27 000		IMP, 1995
Cassiar Coal Ltd.	Stitt Creek	garnet			Cassiar, 1995
Anglo Swiss Ind. Ltd.	Blu Starr	sapphire			Anglo Swiss, 1995
B.C. Chrysolite Corp.	Cassiar	asbestos			B.C. Chrysotile, 1995
Quest Int'l Res. Corp.	Ice	diamond			Quest, 1995
Ava Res. Ltd.	Wishaw	quartzite			Ava, 1995

Note: Estimated Tonnes and Grade are "Resources".

full-time jobs and an estimated 1500 indirect, largely service-oriented, positions. The locations of projects described in this section are shown in Figure 8 and listed, with resources, in Table 3.

The mine life for the **Kemess South**, **Huckleberry** and **Mount Polley** operations is estimated at a minimum of 16 years, 12 to 15 years, and 16 years respectively. Combined annual metal production from the three operations will be approximately 10 885 kilograms (350 000 oz) of gold and 68 540 tonnes (151 million pounds) of copper. Silver will also be produced from each operation as a by-product.

PORPHYRY (AND RELATED) DEPOSITS

Construction at the **Kemess South** project, owned and operated by **Kemess Mines Inc.**, a wholly-owned subsidiary of **Royal Oak Mines Inc.**, began in the summer of 1996, with projected capital costs estimated at \$390 million; it is scheduled to open in the second quarter of 1998. The mine will employ approximately 550 workers during peak construction and create up to 350 new permanent jobs when the operation is running at full production. By late fall 1996 close to 300 workers were on site. Mineable reserves are estimated by the company at 200.4 million tonnes grading 0.63 g/t Au, 0.22% Cu and 0.008% Mo containing 127 525 kilograms (4.1 million oz) of gold and 408 600 tonnes (900 million pounds) of copper. The 45 000-tonne per day milling operation is forecast to produce 7775 kilograms (250 000 oz) of gold and 27 240 tonnes (60 million) pounds of copper annually over its minimum 16 year life. The potential for the discovery of additional resources is good. Several other gold-copper deposits, such as **Kemess North**, with resources estimated at 175 million tonnes grading 0.18% Cu and 0.37 g/t Au, occur in the immediate area of the mine site on claims owned by **Royal Oak Mines**. Funding for development of the **Kemess South** project includes an economic assistance and investment package of up to \$166 million from the **British Columbia** government negotiated in compensation for the **Windy-Craggy** decision.

The company constructed an airstrip and mine workers will be flown to and from the property on a rotation basis. Construction of permanent camp facilities, service complex, mill buildings and a tailings dam are well underway. Clearing of the right-of-way for a 380 kilometre, 230 kV electric transmission line to the **BC Hydro Kennedy Substation** near **Mackenzie** commenced in November. A 59 kilometre access-controlled private haulage road has been proposed to connect the project to the **BC Rail** line near **Sloane**. If

constructed it would be used to transport copper-gold concentrate from the mine to the railhead.

The **Mount Polley** gold-copper project, **Imperial Metals Corporation** (55%) and **Sumitomo Corporation of Japan** (45%), is in the advanced construction stage, with production scheduled for October, 1997. The mine will be developed by the **Mount Polley Operating Company**, and **Sumitomo Corporation** will act as concentrate marketing agent for the partnership. The **Mount Polley** deposit consists of three zones, named the **Cariboo**, **Bell** and **Springer**, with mineable reserves of 82 300 000 tonnes grading 0.3% Cu and 0.417 g/t Au. Annual production, at a daily mill throughput of 18 000 tonnes, is expected to average 3110 kilograms (100 000 oz) of gold and 11 800 tonnes (26 million pounds) of copper over the 12 to 15 year mine life. The operation will create 170 new, full-time jobs. Development of this \$123.5 million project is ahead of schedule and on budget. The concentrator and crusher buildings have been erected; interior construction will continue throughout the winter. Mined and stockpiled ore (approximately 750 000 tonnes of ore and waste) from the first two benches in the starter (**Cariboo**) pit will feed the mill at startup. A 69 kV electric transmission line will be extended from **McLeese Lake** to provide power. Construction of the tailings impoundment will be completed by the end of the year.

On the **Huckleberry** porphyry copper-molybdenum project, **Huckleberry Mines Ltd.**, which is owned by **Princeton Mining** (60%) and the remainder held by a consortium of **Mitsubishi Materials Corporation**, **Dowa Mining Co. Ltd.**, **Furakawa Co. Ltd.** and **Marubeni Corporation**, began construction on June 3, 1996. The project is scheduled for completion in late 1997 at a budgeted capital cost of \$137 million. Mineable reserves are 26 820 000 tonnes grading 0.48% Cu in the **Main zone**, and 72 710 000 tonnes grading 0.52% Cu in the **East zone**. The potential for additional reserves exists locally within the region. By late fall, the company stated that it expected the project to be completed at a cost of \$10 million under budget. The mine will process 16 500 tonnes of ore per day, at an estimated cash operating cost of \$0.65 per pound copper including molybdenum credits. Annual production is projected at 29 500 tonnes (65 million pounds) of copper and 54 tonnes (one million pounds) of molybdenum during a planned 16 year mine life. In addition, the mine will produce 185 kilograms (6000 oz) of gold and 8400 kilograms (270 000 oz) of silver annually. The site is under construction with the permanent camp nearing completion; mill buildings being erected, a tailings impoundment facility

excavated, and soil stockpiled for future reclamation. An eight-kilometre access road has been completed to provide more convenient access to the site via 122 kilometres of road from Houston. A 138 kV power transmission line is proposed to run parallel to the road route. The site will also be serviced by a new airstrip. Up to 300 persons will be involved in the construction phase and the mine will create 180 to 200 permanent full-time jobs during operation.

A detailed pre-feasibility study completed in 1995 on the Taseko Mines Ltd. **Prosperity** (formerly Fish Lake) porphyry gold-copper deposit was based on an open pit "reserve" of 675 000 000 tonnes grading 0.236% Cu and 0.435 g/t Au at a stripping ratio of 1.57:1. The deposit is estimated to contain 292 375 kilograms (9.4 million oz) of gold and 1 589 000 tonnes (3.5 billion pounds) of copper. At a projected 90 000 tonnes per day milling rate, the company forecasts annual production of 11 350 kilograms (365 000 oz) of gold and 69 460 tonnes (153 million pounds) of copper. The mine is projected to have a 21 year life. The capital costs are estimated at US\$430 million, with operating cash costs of US\$0.79/ounce gold, net of copper credits, based on copper at US\$1.00/lb. During the summer of 1996 and continuing through to the spring of 1997, Taseko is carrying out a large (\$13.5 million), in-fill drilling (39 250m in 69 holes) program designed to upgrade previously-drilled holes (*i.e.* preliminary tests in 1995 indicated the potential for an increase of 11% and 4% for gold and copper grades respectively). In addition, 18 holes totalling 3170 m of geotechnical drilling were completed to provide data on pit wall slopes and potential locations for rock dumps, tailings impoundments and other site facilities. Pilot plant metallurgical and process programs, which will include bulk sample testing were also initiated. Other feasibility level engineering studies were underway. The company plans to produce a bankable feasibility study after the completion of the drilling and to enter the Environmental Assessment Process shortly thereafter.

The Placer Dome Inc. **Mt. Milligan** porphyry gold-copper deposit contains resources estimated by the company at 298 400 000 tonnes grading 0.22% Cu and 0.45 g/t Au. Capital costs were projected in the \$500 to \$600 million range in 1993. The company is currently reviewing options to lower this cost; it is developing a revised pre-feasibility study which is scheduled for completion in 1997. It conducted a relatively small program consisting of test pitting and drilling for geotechnical information in the area of the new tailings pond impoundment.

On May 3, 1996 American Bullion Minerals Ltd. (80% interest) presented a pre-feasibility study on

its **Red Chris** copper-gold project, to its partner Teck Corporation (20% interest) for Teck's decision to continue, or not, as operator of the project. Teck elected not to complete a final feasibility study. Since 1994 the companies had spent over \$10.5 million on exploration (74 780m of drilling in 244 holes) defining the Red Chris and Yellow Chris deposits. The pre-feasibility study outlined a resource of 494 000 000 tonnes grading 0.323% Cu and 0.254 g/t Au at a stripping ratio of 1.59:1 and based on a \$8.52 per tonne net smelter return. The deposit is estimated to contain approximately 124 400 kilograms (4 million oz) of gold and 1 589 000 tonnes (3.5 billion pounds) of copper. Based on a daily mill throughput of 90 000 tonnes, annual production is forecast at 5256 kilograms (169 000 oz) of gold and 93 980 tonnes (207 million pounds) of copper. The capital cost is estimated at \$541 million; mine life is estimated at 16 years. As an alternative, the companies examined a revised plan with lower daily mill throughput (*i.e.* 20 000 to 30 000 tonnes) and lower capital costs (*i.e.* \$300 to \$350 million), designed to rework the minable reserve at a higher cut-off grade. During the 1996 field season, American Bullion conducted ongoing environmental and socio-economic studies related to its application for a mine development certification.

International Skyline Gold Corporation increased its resource tonnage in 1996 as a result of a 2000m diamond drilling program on its **Bronson Slope** polymetallic porphyry property, located adjacent to the Snip mine. The company estimates a total resource of 97 920 000 tonnes grading 0.2% Cu, 0.5 g/t Au and 2.65 g/t Ag, at a net smelter return of \$8.00/tonne cut-off. Total contained metals include 56 300 kilograms (1 810 000 oz) of gold, 196 240 tonnes (432 252 000 pounds) of copper and 259 710 kilograms (8 350 000 oz) of silver. Metallurgical tests have demonstrated that molybdenum and magnetite are recoverable; these will add to the resource estimates. The company has begun a series of studies leading to a feasibility stage, based on a 12 000-tonne per day milling operation; it is scheduled for completion in 1997. The company also entered into a series of agreements with Prime Resources Group involving the acquisition of land to enhance the development potential of the project.

In January Royal Oak Mines Inc. completed the acquisition of the **Red Mountain** gold-silver project, 10 kilometres east of Stewart, and created a B.C. Division, with headquarters and offices based in Smithers, to carry on exploration, development, construction and administration for the Kemess South and Red Mountain properties. Between 1991 and 1994 previous owners had spent in excess of US\$30 million in exploration at Red Mountain. During 1996, Royal

Oak with a project budget of \$8 million, drilled a number of targets utilizing up to 6 drill rigs, three at the Rio Blanco zone testing the JW extension, one on the Cambria zone, one at the Hartley Gulch zone and one underground on the JW zone. Deep drilling tested the plunge extension of the Marc-AV-JW zones; the mineralized zones are now interpreted to plunge more steeply to the northwest of the AV zone thereby potentially making the resource more accessible to mine from the valley bottom. A 300m underground extension was also completed. Surface and underground drilling in 1996 identified a new zone of mineralization (S.F.) located at depth to the northwest of the previously-known mineralized zones. Prior to 1996, Royal Oak estimated a resource of 1 921 680 tonnes grading 9.8 g/t Au. It is working on a revised estimate which is expected to increase the tonnage significantly, but the grade will be lower.

Teck Corporation drill-tested (in excess of 14 000 m) a number of targets in the Iron Mask region principally in the area between the Afton and Ajax deposits. Teck (70%) also continued to drill-test the **Rainbow** No. 2 porphyry copper-gold target, under a joint venture agreement with owner Getchell Resources Inc. (30%). A total of 71 holes have been drilled on the project resulting in geological reserves for the No. 2 zone estimated at 14.1 million tonnes grading 0.5% Cu, plus potential credits in gold and molybdenum to a depth of 300 metres. Drilling in 1996 tested a new zone of copper and gold mineralization discovered while testing the No. 2 zone in late 1995. Teck, Getchell and Afton Operating Corporation are evaluating the data to determine the extent of the next phase of exploration. One alternative involves underground mining, which would require a costly deep-drilling program to define deep, higher grade reserves. If successful, mineralization would be treated at the nearby Afton mill.

Also in January and February of 1996, Teck Corporation, under an option agreement with Getchell Resources Inc., completed a 32-hole diamond drilling program on Getchell's **Galaxy** property, with estimated resources at 3.2 million tonnes grading 0.65% Cu and 0.34 g/t Au. After an evaluation of the results by Afton Operating, Teck decided not to proceed with further exploration or development. For other target areas investigated, *see* Operations Metal Mines.

In the Greenwood camp, Britannia Gold Corporation and Bren-Mar Resources Ltd. completed a production-size, 600-m long decline, and an underground diamond drilling program to define high grade resource, previously estimated at 162 000 tonnes grading 8.9 g/t Au and 0.96% Cu for the **Lexington**

Main zone. The decline is being extended a further 235 metres to allow underground diamond drilling of the 'lower' Main zone. Preliminary draft permits have been received to allow mining at 25 000 tonnes per year and processing of the ore at a nearby custom milling facility.

Imperial Metals Corporation completed an airborne geophysical survey over the **Giant Copper** property, and did follow-up diamond drilling on the Invermay zone. Drilling on the AM zone last year was designed to increase the near-surface tonnage, which is estimated to contain an open-pit resource of 29.5 million tonnes grading 0.65% Cu, 0.38 g/t Au and 12.34 g/t Ag. Drilling on the Invermay zone, located 1.5 km northwest of the AM zone, was aimed at establishing a second open-pit resource on the property. Preliminary results from the Invermay zone are very encouraging; the company believes it is testing a porphyry- to-transitional-type deposit, with the mineralization contained within a tourmaline breccia.

Camnor Resources Ltd., under a joint venture agreement with Gold Giant Minerals Inc., completed approximately 1750 metres of surface drilling on the Kiwi, Lower Icefall, Wilby, Wilkie and Edge zones, as well as underground drilling (20 holes totalling 1697 metres) on the North and North-North zones on the **Willoughby** project. The underground adit on the North zone was advanced 40 metres for a total length of 90 metres, as part of the overall \$1.3 million program. The drilling tested the zone along a strike length of 100 metres, a minimum dip length of 75 metres. Widths are variable to 8 metres, grades are highly variable, but high-grade intersections are reported. Drilling on the Wilkie zone tested a 60 metre strike segment at down dip depths of up to 70 metres; widths are variable to 3 metres. In drill testing for the extension to mineralization in the Wilby zone, a new sulphide lens, consisting of extensive pyrite/pyrrhotite mineralization, the Northern Deep, was discovered. Both the Wilby and Northern Deep lenses have been traced for 150 metres along strike with widths variable to 25 metres.

MASSIVE SULPHIDE DEPOSITS

Redfern Resources Ltd. continued to conduct on-site environmental and socio-economic studies, associated with its application for a project approval certificate for its **Tulsequah Chief** volcanogenic massive sulphide deposit. Metallurgical studies were ongoing with a two-fold objective of reducing the lead in the bulk copper-lead concentrate, and concurrently producing a saleable lead concentrate. Redfern filed a project report under the Environmental Assessment Act in November. Contingent on project financing and government approval, the company could start detailed

engineering design and construction on the project in 1997.

In the Gataga district, southeast of the Cirque zinc-lead-silver deposit, Inmet Mining Corporation continued to explore the depth potential of the **Akie** zinc-lead-silver sedex deposit it holds under an option agreement with Ecstall Mining Corporation. The Cardiac Creek zone has been traced by drilling along a strike length of 1400 metres, a thickness ranging from 10 to 30 metres, and to depths of 600 metres. Inmet has estimated a geological resource of 12 million tonnes grading 8.6% Zn, 1.5% Pb and 17.1 g/t Ag over a strike length of 1 kilometre. Due to structural complications encountered in the deep drilling program in 1996, Inmet terminated the program early, after completing one new deep hole and one started in 1995. The new hole completed (A-96-29) was drilled to test for a continuation of massive sulphide mineralization at a point 400 metres downdip of the previous deepest intersection of the Akie deposit made by hole A-95-18 in 1995 which intersected mineralization averaging 9% combined lead and zinc over 9.5 metres. Surface drilling also tested the strike projection to the north and south of the Cardiac Creek zone at 1-km intervals over a distance of approximately 7 kilometres. Encouraging results were reported, particularly from the northern end of the property.

VEIN DEPOSITS

Bralorne-Pioneer Gold Mines Ltd., in a joint venture with International Avino Mines Ltd., purchased a 150 tonne per day milling plant from Zeballos and re-installed it at the **Bralorne** site. Existing geological reserves above the 800 level (main haulage tunnel) are 432 500 tonnes grading 10.63 g/t Au. The resource below the 800 level is estimated at 549 125 tonnes grading 9.26 g/t Au. Initial production, scheduled for late 1997, will start above the 800 level. Four key zones, Peter, Big Solly, Millchuk and Maddy, discovered over the past several years, offer good potential to increase reserves. Bralorne-Pioneer has proposed mining from the Peter vein on surface to provide early mill feed. The initial capital cost is estimated between \$5 and \$7 million.

At the **Golden Bear** mine site, Wheaton River Minerals Limited and North American Metals Corporation carried out detailed surface diamond drilling on the Kodiak B and Ursa zones, as well as on several coincidental geochemical and geophysical anomalies located west of the Ophir Break (West Wall fault) in the host carbonate complex. A 61-hole reverse circulation drilling program also further tested the East Low Grade Stockpile zone, which had previously

calculated resources estimated at 2 470 000 tonnes grading 1.3 g/t Au. The mine was originally built at a capital cost of \$89 million and between 1989 and 1994, 6780 kilograms (218 000 oz) of gold were recovered from underground and open-pit mining on the Bear Main zone refractory ore. The \$1.7 million 1996 exploration program was aimed at defining additional reserves to add to a long-term, heap-leach mining program. An expanded feasibility study, completed in late 1996, involving mining and milling of material from the Kodiak A and Ursa zones, estimated the recovery, by heap leach methods, of approximately 6656 kilograms (214 000 oz) of gold from 1 528 000 tonnes grading 5.1 g/t Au over a six-year period at a total cash cost of US\$232 per ounce. Mineable heap leachable reserves in the Ursa zone are estimated at 511 000 tonnes grading 7.0 g/t Au. Condemnation drilling has allowed for the selection of a preferred site for a second heap leach pad; an amended government permit has been received for the second site. The installation of the soil liner for the Kodiak A zone, with a permitted capacity of 325 000 tonnes and a maximum 21m height, was partially completed in 1996.

Reserves in the Kodiak A zone are estimated at 824 000 tonnes grading 3.3 g/t Au. In addition, a 10-hole, in-fill drilling program on the Kodiak B zone was successful in increasing probable geological reserves to 278 112 tonnes grading 8.6 g/t Au. A new mining plan has placed the reserves into the mineable category and added them to a long-term plan for the Kodiak A heap leach pad. Stacking of the pad with Kodiak A ore is scheduled to commence in June 1997; the first gold pour is scheduled for mid-August 1997. Wheaton forecasts 1997 gold production of 778 kilograms (25 000 oz) of gold.

Testing of several anomalies in the West project resulted in the discovery of three new gold zones, all within the carbonate complex. The C+C zone was located along the 5-km long Limestone Creek fault, located approximately 2-3 kilometres west of the Ophir Break. Other resources have been identified in the Kodiak C and Grizzly zones; these additional resources are estimated at 8615 kilograms (277 000 oz) of gold. Total resources in all categories at Golden Bear are estimated by the company at 15 270 kilograms (491 000 oz) of gold.

At the **Taurus** gold project in the Cassiar camp, Cyprus Canada Inc., under a joint venture agreement with International Taurus Resources Inc. and Cusac Gold Mines Ltd., continued its aggressive exploration program to delineate a large tonnage, low-grade, bulk mineable, potentially heap-leachable deposit in the spring of 1996. This program included surface drilling on several induced polarization targets outside

the main zones, plus an extensive trenching and surface mapping program in the proposed starter pit area of the 88 Hill zone. In 1995, a consultant to International Taurus estimated the size of the gold deposit on the Taurus property to be at least 118 million tonnes grading 1.0 g/t Au. Furthermore, International Taurus estimated a potentially mineable resource within the 88 Hill zone of 43 545 kilograms (1.4 million oz) of gold in 45 350 000 tonnes grading 1.05 g/t Au. The early 1996 trenching program by Cyprus on the western half of the zone indicated a potential to increase the resource tonnage and grade. The trenches demonstrated continuity of individual zones up to 100 metres in strike length, within an overall strike length of approximately 1000 metres.

In July 1996, Cyprus relinquished its agreement as the size of the Taurus deposit failed to meet the company's requirements. International Taurus re-acquired a full interest in the property; it also reached an agreement with Cusac to earn up to a 70% interest in claims held by Cusac as part of the Taurus project. International Taurus immediately began an infill reverse circulation drilling program, at 25 metre centres, on the 88 Hill zone. It also completed additional trenching in the 88 Hill zone; this identified mineralization beyond the limits of the trenching program completed earlier in 1996 by Cyprus, and has confirmed a southern mineralized area up to 100 metres in width and several hundred metres in length. International Taurus completed 36 reverse circulation and 4 diamond drill holes in the 88 Hill zone (500m by 200m); drilling extended the zone 300 m to the west. It has calculated a preliminary drill-indicated reserve of 13 725 350 tonnes grading 1.01 g/t Au, and an inferred reserve of 25 134 000 tonnes grading 0.67 g/t Au. This places nearly 31 104 kilograms (1 million oz) of gold in a reserve category.

At the **Specogna** (formerly Cinola) gold deposit, which is part of Misty Mountain Gold Ltd.'s Harmony Gold project on Graham Island, Queen Charlotte Islands, a multi-million dollar diamond drilling program, on a 20 x 20 metre grid, with all holes angled towards the southeast, was conducted in 1996 and will be completed in the first quarter of 1997. Previous work by other operators had defined an open-pit mining resource of 31.3 million tonnes grading 2.2 g/t Au at a stripping ratio of 1.7:1. The drilling was oriented to the southeast at -45°, designed to crosscut at right angles the northeasterly-trending larger veins that dip to the northwest. Previous drilling in late 1995 and early 1996 demonstrated a 24% increase in gold grades in that portion of the deposit tested and the existence of high grade bonanza zones locally. When the drilling is completed in 1997, the deposit will have been tested

over its 610m length, 210m width, and over 300m down-dip, and this will enable the company to calculate gold reserves. Mining plans will examine both the bulk-mineable, low-grade and the high-grade, bonanza (underground) potential of the deposit. Metallurgical and environmental studies are underway in preparation for the commencement of feasibility studies. Based on preliminary drilling (holes 95-001 to 96-088), Misty Mountain has calculated a preliminary geological resource estimate in the 62 207 kilograms (2 million oz) of gold range. Since 1995 Misty Mountain has completed more than 33 000m of drilling in over 140 drill holes.

In late 1996, Golden Angus Mines Ltd., a wholly-owned subsidiary of Canarc Resource Corporation, began a multi-million dollar underground exploration and development program on its **Polaris-Taku** project in the Tulsequah area. Drill-indicated geological reserves, contained in the AB, Y and C vein systems, were estimated in 1996 at 3.27 million tonnes grading 13.7 g/t Au at a cut-off grade of 6.86 g/t Au. A base case production model, proposed in 1996, forecasts annual production of 2800 kilograms (90 000 oz) of gold over a minimum 8-year mine life. Capital and cash operating costs are estimated at US\$50 million and US\$220 per ounce of gold respectively. Initial underground work will include rehabilitation, sampling and drilling of the upper workings on the AB and Y vein systems between the Canyon adit and the surface to test for potential open-pit resources, and testing the bottom of the mineralization below the 750 level on the C veins and the possible depth extension of the AB vein system. A recently completed geological review by the company had identified 39 separate drill targets, as well as 35 individual reserve blocks covering every level of the mine workings. The planned 200 drill holes in the 1996-1997 program are designed to increase the contained resource of 44 790 kilograms (1.44 million oz) of gold and to define a minimum of 22 395 kilograms (720 000 oz) of gold as mineable resources, sufficient to complete a bankable feasibility study for production in the spring of 1998. Engineering, environmental, metallurgical studies and permitting have commenced in preparation for an Application under the Environmental Assessment Process.

In 1995 Fairfield Minerals Ltd. sold 118.4 kilograms (3807 oz) of gold and 185 kilograms (3950 oz) of silver, recovered from 1840 tonnes of ore, from its bulk sampling program on the Siwash North vein on the **Elk** property and treated at the Asarco smelter at Helena, Montana. Reserves estimated by the company at January 1, 1996 were 121 350 tonnes grading 25.4 g/t Au and 35.3 g/t Ag. These include a diluted, probable, open-pit resource of 11 340 tonnes grading 58.97 g/t

Au, an underground probable resource below the open pit of 20 225 tonnes grading 26.74 g/t Au, and a further possible underground resource of 89 790 tonnes grading 23.66 g/t Au. Past production included 14 620 kilograms (47 000 oz) of gold from open pit mining between 1992 and 1994, and 117 kilograms (3750 oz) of gold from underground test mining in 1994. A total of 994 metres of ramp access and three development levels exist underground. During September, Fairfield shipped all remaining stockpiles of gold mineralization, estimated at 2700 tonnes and grading greater than 12 g/t Au, (*i.e.* contained 283 kilograms (9100 oz) of gold and 358 kilograms (11 500 oz) of silver) to the Asarco smelter.

The 1996 exploration program consisted of 6873m of drilling in 91 holes, to test vein extensions below the underground development from 180m to 275m along a horizontal strike length of 210m, to complete in-fill drilling in the area of the open-pit resource and to test an area approximately 610m east of the current pit. The Siwash North zone has been traced along a 914m strike length and downdip to 245m. In addition, five other promising auriferous vein systems have been identified. In June 1996, Fairfield made an agreement with Almaden Resources Ltd. to take over management of the company. In July, Aurizon Mines Ltd. and Fairfield signed an option agreement, subject to a 60-day due diligence period; however, in September, Aurizon relinquished the option stating that the project did not meet its corporate goals. Fairfield continued with its drilling program, which resulted in the discovery of a new vein (WD vein), 200m north of the Siwash North vein and parallel to it. The drilling emphasis quickly shifted from the underground target to the new discovery; a total of 2630 m in 24 drill holes tested the vein for a 550 m strike length and downdip for 230 m.

In the spring of 1996, Huntington Resources Ltd. completed a 45m bypass tunnel to circumvent a caved portion of the 240 m long adit at the 1205 m level on the Bonanza zone of the **Brett** epithermal gold deposit. Between late 1995 and spring 1996, it mined and stockpiled approximately 1100 tonnes of mineralized rock, with an expected grade of 5.76 g/t Au. A 1992 resource estimate for the Bonanza zone identified approximately 12 000 tonnes grading 39.1 g/t Au. By the end of 1995, approximately 250 tonnes grading 34.18 g/t Au and 63.43 g/t Ag were mined from the surface of the high-grade R.W. vein and stockpiled. This material was trucked to Cominco's Trail smelter in early July for processing and sale. Concurrently, surface mining on the RW vein continued with the aim of stockpiling a further 250 tonnes grading 42.9 g/t Au for later shipment to Trail. The first shipment confirmed a

preliminary forecast of 96% recovery of gold, and a silica content in the 80% range plus the logistics of mining, shipping and processing. In December, the company began driving a 27m raise in the hanging wall to mine ore in the Bonanza zone.

At the **Blackdome** gold mine, Claimstaker Resources Ltd. and joint venture partner Petro Plus Ltd., conducted a program of trenching, drilling and underground drifting and raising in search of new reserves on veins identified by previous work. Between 1986 and 1991 production totalled approximately 7000 kilograms (225 000 oz) of gold and 17 100 kilograms (550 000 oz) of silver at an average grade of 21.94 g/t Au and 51.1 g/t Ag. The on-site, 190-tonne per day mill facility is available and could be easily recommissioned with minor changes. A recent study by the company has outlined a resource of 159 600 tonnes grading 16.11 g/t Au and 37.0 g/t Ag, or approximately 233 kilograms (75 000 oz) of contained gold. The initial work was aimed at confirming resources so that a production decision can be made; the base target is 3110 kilograms (100 000 oz) of gold. A trenching program tested a new zone south of the rhyolite zone which appears to parallel the No. 1 and No. 2 vein structures. Follow-up diamond drilling tested the northern extension of the No. 2 vein. A raise was driven 12.8m on the No. 2 vein in the new zone, and 18m of drift advancement was completed on the No. 11 vein on the 1870 level. Encouraging results have been reported.

Athabaska Gold Resources Ltd. continued underground drilling and development on the Idaho zone and surface drilling in the McMaster zone on its past producing **Ladner Creek** (Carolin) gold mine, 18 kilometres northeast of Hope. These turbidite-hosted, mesothermal, epigenetic deposits were mined by underground techniques between 1982 and 1984. The mill, with a daily throughput capacity of 1360 tonnes, remains on site. Drilling in 1996 increased the underground resource by 272 100 tonnes. The current underground resource, estimated by the company, is 1 621 715 tonnes grading 4.42 g/t Au, plus an additional tailings resource 598 620 tonnes grading 1.75 g/t Au, for a cumulative resource of 8 205 kilograms (263 800 oz) of contained gold. A trenching program was aimed at defining an open-pit resource over the surface projection of the main Idaho zone. Bulk sample metallurgical testing was completed and confirmed that gold recoveries will be in the 85% range. The optimum mill process will be a simple flotation-only circuit with the gold-bearing concentrate being shipped to a custom smelter. Work in the first year of operation will consist of reprocessing the tailings; underground mining would follow. Total capital costs to reactivate both the mine and the mill are estimated at \$8.1 million. Average

annual production from underground is forecast to be 1 646 kilograms (52 940 oz) of gold, at a cash operating cost of US\$380 per ounce gold. Mine life is currently estimated at 4 years; however, the potential for discovery of additional resources is considered excellent. Also, Athabaska continues to explore for other opportunities on a 15-kilometre long stretch of the Coquihalla Gold Belt along the East Hozameen Fault. In particular, encouraging results were reported from a late fall drilling program on the McMaster zone.

INDUSTRIAL MINERAL DEPOSITS

In 1996 exploration expenditures are estimated at approximately \$1.7 million, a decrease from the \$4.5 million spent in 1995.

Mountain Minerals Company Ltd. is developing a market for **zeolite**, in a variety of agriculture applications within Alberta, for its product from the **Ranchlands Z-1** and **Z-2** pits near Cache Creek. In 1995, Canmark International Resources Inc. mined a 10 000 -tonne bulk sample from the **Sunday Creek** deposit near Princeton to develop a market in the Lower Mainland. Market tests are continuing.

Quinto Mining Corporation Ltd. and IMP Industrial Mineral Park Mining Corporation continued sampling and evaluation of **graphite/sericite** and **graphite** from their **Lumby** and **Black Crystal** (near Slocan) properties respectively. IMP estimates a resource of flake graphite of over 27 million tonnes in the Black Crystal deposit. The company stockpiled graphite at the mill which is nearing completion. It processed 5.5 tonnes at Quinto's laboratory in Lumby.

Super Twins Resources Ltd. continued exploration of the **Isk wollastonite** deposit on Zippa Mountain in the Iskut River area. It reported a potential open pit resource of 2 million tonnes of high purity wollastonite from the Cliff zone, one of five known zones. Drilling also tested the Cliff, Bartnick and Brill zones. The Brill deposit, 300m long by 100 m wide, was defined by the company as having the best potential for mining and additional reserves. The company hoped to establish a proven reserve of 18 million tonnes. A mine feasibility study is underway for production targeted to commence in 1997. Simple bench mining, slurry pipeline transport of the crushed wollastonite to the tidal Stikine River and then barging to a suitable port is proposed.

After the discovery of gem-quality **sapphire** in the Slocan Valley (**Blu Starr** property), Anglo Swiss Industries Ltd. continued sampling and evaluating the economic potential of numerous prospects. It also conducted systematic prospecting of alkaline rock

occurrences in core gneiss units of the Omineca Crystalline Belt. It is plans to utilize its crushing, milling and laboratory facility located at its Kenville mine property, 30 kilometres by road from the Blu Starr deposit. Other minerals discovered include tourmaline, beryl, topaz, ruby, amethyst, and Japan quartz crystals. Gem-quality **aquamarine** has been found in pegmatitic dikes in the Valhalla Gneiss Complex near **Airey Creek**, west of Slocan Valley. High-quality, black and smoky grey quartz crystals are also common.

The **Klinker fire opal** locality near Vernon, being operated by Okanagan Opal Inc., has sparked some interest and at least two sites were discovered in 1996. Small scale test mining and marketing is ongoing.

Mining companies, as well as individual prospectors, are evaluating new **dimension stone** properties. Rose-pink granite and brown syenite were sampled for testing near Grand Forks, and a **flagstone** property was discovered near Nipple Mountain, east of Kelowna.

A **sodalite** occurrence at Mt. Laussedat, north of Golden, produced several thousand pounds of low-grade sodalite rock in 1996.

A pilot plant to process **Cassiar asbestos** tailings to recover the short fibre has been assembled by B.C. Chrysotile Corporation and processing may commence in 1997.

Quest International Resources Corp. reported the discovery of two new kimberlite pipes and a 1.5 mm gem-quality **diamond** fragment on its **Ice** property near Elkford, southeast British Columbia. Five kimberlite pipes were previously identified. A bulk sample of 27 tonnes was taken from each of three kimberlite pipes (Ram 5, Ram 6 and Ram 6.5) and a 4.5 tonne sample was taken from a kimberlite dike exposed in a road cut. a total of 86 tonnes of kimberlite material has been shipped to Fort Collins, Colorado for diamond testing.

Ava Resources Ltd. rehabilitated the access road to its attractive pink, banded **quartzite** deposit (**Wishaw**), east of Prince George, in preparation for test quarrying and sampling.

Dome Creek Structural Slate Company planned to extract blocks of **slate** from its **Dome Creek** property, east of Prince George, for shipment to Wales for testing but development work in 1996 was unsuccessful.

Cassiar Coal Company Ltd. continued development work on its **Stitt Creek placer garnet** property north of Revelstoke.

Highland Talc Ltd. is also active in developing the **Talc** Group claims north of Boston Bar.

COAL

There were at least seven coal exploration programs in 1996, which were not on existing mine leases. Expenditures are estimated at approximately \$4.5 million, a significant increase from \$1.5 million in 1995. Predictions are for strong thermal coal markets and this has renewed interest in those coal deposits close to existing infrastructure, or in the case of Tsable River, close to tidewater. The outlook for metallurgical coal is for stable markets with a decrease in imports by Japan being offset by increased imports by other Far East countries. There is also a shift from hard coking coals to weak and semi-soft coking coals. This may offset losses in hard coking coal markets by providing additional markets for some BC coals, albeit at a lower price.

At the **Telkwa** thermal coal project, Manalta Coal Limited conducted an extensive exploration program, including the drilling of 100 holes totalling 15 000 metres. Drilling in the Tenas Creek area, south of the Telkwa River, has proved significant resources in three shallow-dipping coal seams. The property now has four areas with mineable coal reserves. In the early 1980s, an open-pit resource was delineated east of Goathorn Creek (pit No. 3). In the early 1990s, pits (No. 7 and No. 8) were delineated north of the Telkwa River. This year, in addition to drilling, a bulk sample was excavated in the Tenas Creek area to provide coal quality and acid rock data for the Number 1 seam, which constitutes the current resource for this area. The Telkwa deposits are being computer modelled as an initial step towards a mining feasibility study. Preliminary plans call for mining with a plant on the Tenas deposit south of the Telkwa River, followed in later years by mining in the Pit 7/8 area. Manalta plans to enter the Environmental Assessment Process for a project approval certificate. The British Columbia Geological Survey Branch has an ongoing program examining the sulphur distribution in coal samples from the Tenas Creek area.

At the **Tsable River** project, south of Courtenay on Vancouver Island, Quinsam Coal Corporation (63%) and Marubeni Corporation (37%) conducted a large exploration drilling program (planned 27 holes totalling 7000 metres). An underground mine north of Tsable River closed in 1966 after producing a total of 1.8 million tonnes. The 1996 exploration program was south of Tsable River and to the east of the old mine. It was designed to increase the reserves in an area where a previous exploration program

conducted in 1991 outlined at least 11 million tonnes of underground mineable coal. The program succeeded in increasing in-situ reserves in all categories to 38 477 900 tonnes, which would be sufficient for a 1 million tonne per year mine if the product is marketable. The company is currently assessing the coal quality and environmental and mine planning studies are in progress. A British Columbia Geological Survey Branch project is under way to measure methane in the core samples. Data will provide information for mine safety and an assessment of coal bed methane resources in the area.

In the northeast at the **Willow Creek** project, a joint venture between Globaltex Industries Inc., Mitsui Matsushima Canada and BCR Ventures conducted an advanced-stage drilling program. The drilling started in June; a total of 240 holes were completed (7500 metres). The drilling concentrated on increasing reserves in the Willow Creek East block and helped to better define the coal quality. Various environmental studies are ongoing and the companies hope to receive approval-in-principal for a 500 000 tonne per year mine in late 1997. Seven low-volatile coal seams with a total thickness of 20 metres have been identified; preliminary resources are estimated at 27 million tonnes of metallurgical coal. A full feasibility study is planned to be completed by late 1996-early 1997; employment during full operation is forecast at 80 to 100 persons.

North of the Line Creek mine on **Mount Michael** Ridge, Line Creek Resources Ltd. conducted a helicopter-supported 6-hole drilling program totalling 2500 metres at a cost of about \$500 000. The drilling confirmed earlier interpretations based on surface geology. The British Columbia Geological Survey Branch continues to appraise the coal quality characteristics of the Gething Formation in the northeast.

In the southeast, a small exploration program including a proposed bulk sample test of 2000 to 5000 tonnes was conducted on the **Iron Creek** (formerly Bingay Creek) prospect. There has been no activity on McGillivay Mining Ltd.'s **Loop Ridge** metallurgical coal property in the Crowsnest Pass. The company hopes to negotiate an agreement whereby raw coal can be trucked to either the Coal Mountain or Elkview wash plants.

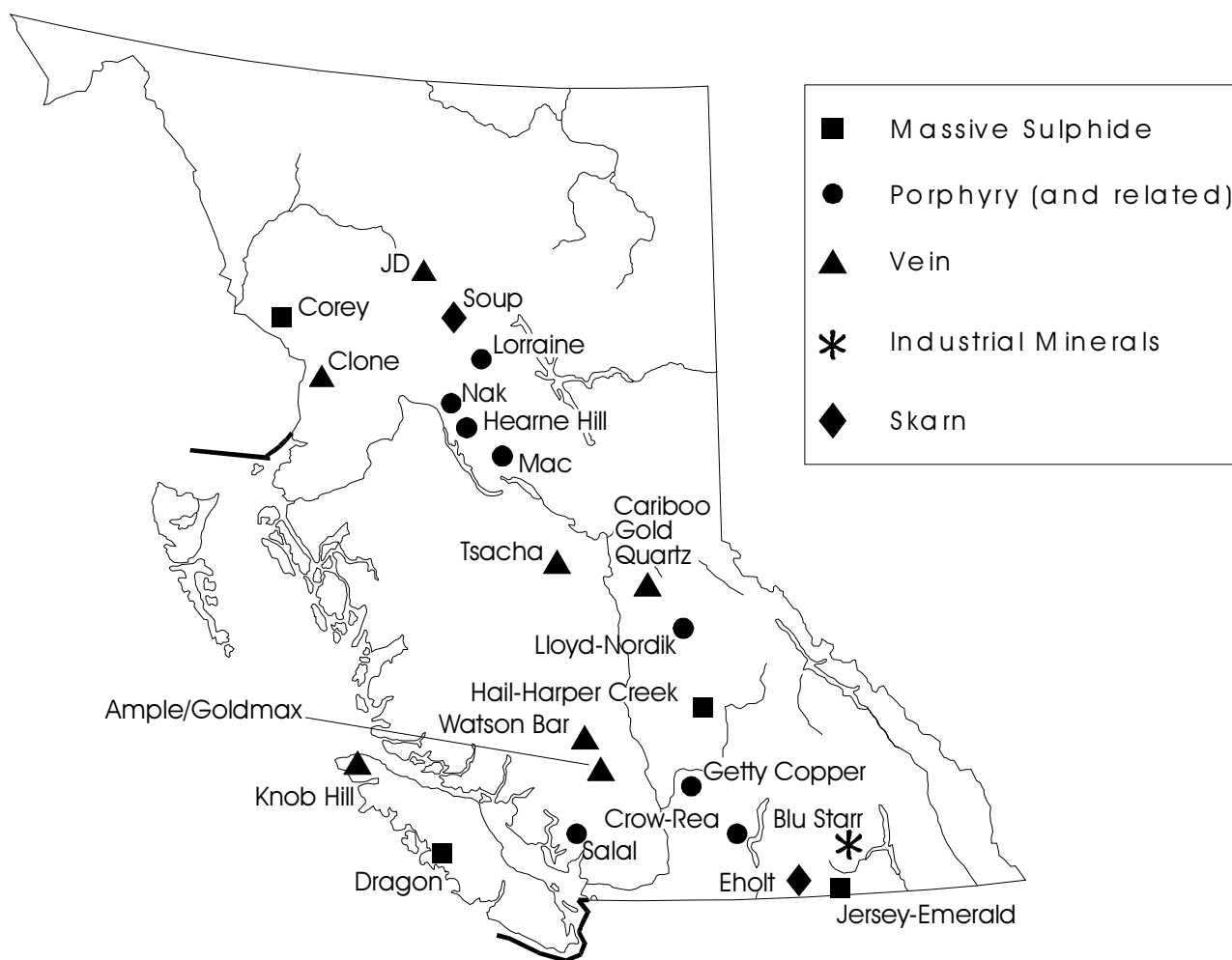


Figure 9. Major exploration projects in British Columbia - 1996.

GENERAL EXPLORATION HIGHLIGHTS

Gold-enriched porphyry copper (\pm molybdenum) and porphyry-related gold deposits, polymetallic massive sulphide deposits (volcanogenic, seafloor hydrothermal and sedex), and vein deposits (epithermal and mesothermal) accounted for approximately 86% of 1996 exploration expenditures in British Columbia. The remainder were directed to coal, industrial minerals, skarns and less traditional targets such as ultramafic-hosted nickel and redbed copper. Of the total estimated \$100 million exploration expenditures, only approximately 12% are in the less advanced to grassroots category addressed in this section. Although most of the programs were focused in and around areas with mines, mines under construction or new showings and existing infrastructure, several new, relatively low budget, regional programs were conducted throughout the province. As some claims lapsed, they were restaked

by others who plan future work. The diversity of targets, from large, world-class deposits to smaller but profitable targets, and the profitability of these smaller, higher grade deposits such as Eskay Creek and Snip, continue to make British Columbia a good place to explore. The properties reported on are shown on Figure 9 and listed in Table 4, with estimated reserves, where available.

PORPHYRY AND PORPHYRY-RELATED DEPOSITS

The **Babine Camp** was very active in 1996. Booker Gold Explorations Ltd. continued to diamond drill high-chargeability and low-resistivity induced polarization anomalies on its **Hearne Hill** porphyry copper-gold breccia property, 20 km north of the Bell mine. Previously, the Chapman breccia zone had an estimated resource of 180 000 tonnes grading 1.74% Cu. Drilling approximately 200m to the northwest in 1996 located a new zone, the Peter Bland zone.

Continued induced polarization surveys identified additional anomalies along a north-northeasterly trending strike length of over 1 kilometre. Individual breccia zones tend to pinch and swell; however, the company hopes that with further work, better continuity between zones can be established. The Peter Bland zone is estimated to be 500 m in length, 200 m in width and at least 460 m in depth. Within this zone, the company has outlined a high-grade core 460 m in length, 45 m in width and 460 m in depth. Till geochemical sampling has been particularly useful in defining drill targets. One such target was identified 80 m to 100 m to the west of the core zone, and may be a parallel system. Drilling confirmed the presence of porphyry -type mineralization in this area. Drilling is planned throughout the winter.

At the **Nak** porphyry copper-gold-molybdenum prospect, 30 km northeast of the Bell mine, Hera Resources Inc. continued drilling later in the season, with a focus on the southern area of the 2.5 km by 1.5 km alteration system. Approximately 5200m of drilling were completed in 27 holes. Encouraging results included the discovery of high-grade copper mineralization associated with a strongly tourmalinized structure. The reconnaissance drill program, with expenditures of over \$2 million to date, has indicated a mineral resource of 45.4 million tonnes grading 0.70% copper equivalent. Hera also completed a program of geological mapping, geochemical and geophysical surveys on its **Trail Peak** porphyry prospect, 55 km northwest of its Nak property. The surveys identified a well-defined, central induced polarization anomaly of 1000 m by 800 m; the overall system is indicated to be over 2 km in length. A comprehensive drill program is planned for early 1997. Teck Corporation conducted follow-up evaluation of a number of anomalies identified from its 1995 airborne survey. The British Columbia Geological Survey Branch conducted a 1:50 000 mapping program, till sampling, surficial mapping and a lake sediment survey in the region as part of the federal-provincial NATMAP program.

Spokane Resources Ltd. entered into an agreement to acquire from Rio Algom Exploration all right, title and interest in the **Mac** molybdenum-copper property, 40 km southeast of the Granisle and Bell mines, for 1.5 million shares. Drilling during the winter of 1995 and 1996 outlined three distinct zones of porphyry molybdenum ± copper mineralization contained within an alteration zone estimated to be 3.5 km long by 2 km wide: the Camp, Peak and Pond zones. Prior to conducting a further \$910 000 diamond drilling program in the fall of 1996, Spokane carried out additional induced polarization surveys, geochemical sampling and detailed geological mapping. The access

route was also improved. A total of 4634m were drilled in 34 holes. Drilling targeted the Camp zone which is estimated to be 700 m in length, 300 m in width and at least 150 m in depth. The company estimates the zone has a potential geological resource of approximately 100 million tonnes with an expected average grade of 0.15% MoS₂ and 0.12% Cu. Included within this estimate is the potential for approximately 20 million tonnes with an expected average grade of 0.25% MoS₂ and 0.2% Cu. Drilling in this zone further defined the lateral and vertical extents of mineralization and extended the known mineralization. Drilling on the Peak zone, located 1 km south of the Camp zone, suggests an area of molybdenum-copper mineralization 1 km in length by 500 m in width, with the potential to host in excess of 150 million tonnes of mineralization. Drilling in 1996 indicates that the Peak and Camp zones are part of the same porphyry systems; the Peak zone appears to host more amounts of copper than the Camp zone. The Pond zone, located approximately 1 km north of the Camp zone, is estimated to be approximately 2 km in length and 2 km in width. Several additional targets have been identified. The Mac deposit represents a rather unique metal association, *i.e.* between an Endako molybdenum-type and a Bell copper-type.

At the **Lorraine** copper-gold-silver project, Lysander Gold Corporation expanded its claim holdings north and east to include a contiguous block totalling 250 sq. km., including the PAL claims and the Steelhead, Dorothy, Lorraine and Boote Steele properties. Previous drilling by the company in 1994 and 1995 has indicated significant values in copper and gold (*e.g.* 4.5 million tonnes grading 0.75% Cu and 0.34 g/t Au in the Upper Main zone). The company also believes it has identified a major buried alkalic centre lying immediately to the east of the Lorraine property. A strong, circular magnetic ring (the Jajay Ring), 10 km in diameter with all known zones of mineralization around its rim has been outlined and will be the focus of a major exploration program in 1997. A modest drilling program of 10 holes in 1996 tested extensions to the Upper Main zone at depth, the southward extension of the Bishop zone by 300m, the potential for higher grade gold mineralization in the Eckland zone and the North Cirque zone. Geochemical sampling in the latter indicated the potential for a large new zone containing copper and gold.

In the northern part of the Highland Valley, southwest of Kamloops, Getty Copper Corporation conducted drilling programs on the **Getty North (Krain)** and nearby targets; the entire property encompasses approximately 100 sq km. At Getty North, Getty estimates indicated resources at 21 million

tonnes grading 0.44% Cu, of which approximately 5 million tonnes is oxide material. Recently completed leach testing on a bulk sample resulted in a 82.4% copper recovery over a 120-day period. This material would be further processed using the solvent extraction-electrowinning process. Drilling is continuing throughout the winter. The company has identified the presence of significant supergene mineralization adjacent to the northeast portion of the Getty North deposit, beneath the Tertiary volcanic cover. Drilling is also testing an area approximately 1 km south of the deposit. Getty is evaluating the 1996 results and is planning a property wide program in 1997.

Verdstone Gold Corporation and Molycor Gold Corporation diamond drilled two deep holes on their Climax-Henderson-type **Salal Creek** (Float-Creek zone) molybdenum prospect, 70 km northwest of Pemberton. In addition, extensive surface sampling and mapping was completed in an area 1500 m long by 910 m wide, over the Float Creek zone. Prospecting also located new zones of molybdenum mineralization on Plug Creek, 300 m west of Float Creek, in Hit Creek Canyon, 800 m east of Float Creek and Red Mountain, 2000 m northeast of Float Creek. Previous work by Amax, Cerro, BP Minerals and Utah has outlined a mineralized area measuring approximately 2500 m by 460 m with Float Creek being the centre. The companies plan to continue the deep drilling program in 1997.

During 1996 Big Valley Resources Inc. conducted diamond drilling on the Lloyd 2 deposit on its **Lloyd-Nordik** copper-gold property, 1.5km north of the Mount Polley open pit development. The Lloyd 2 zone mineralization consists of pyrite and chalcopyrite in a monzonitic felsic breccia healed with magnetite. Similar mineralization occurs at the Road showing at Mount Polley which lies immediately to the east. In March 1996 the company reported a preliminary resource estimate for the Lloyd 2 target of 7 190 000 tonnes grading 0.31% Cu and 0.243 g/t Au, based on a copper equivalent cut-off grade of 0.1%. A revised estimate is expected in November. The drilling has also yielded several high-grade intersections of copper and gold. Trenching and drilling has also been conducted on the Lloyd 1, 3, 4, Nordik SE and BV zones. Drilling is continuing throughout the winter.

During 1996, Verdstone Gold Corporation and Molycor Gold Corporation completed 8230m of diamond drilling and 2740m of percussion drilling on their **Crow-Rea** porphyry molybdenum prospect located 24 km south of the Brenda mine. The companies have identified a drill-indicated reserve on the Webb

site zone of 500 000 tonnes grading 0.32% MoS₂. Several anomalies remain to be tested.

PRECIOUS METAL BEARING VEINS AND BULK-MINEABLE DEPOSITS

Exploration targets in this category cover a broad spectrum of hydrothermal, epigenetic mineral deposits. They include principally gold-and/or silver-bearing, high-level epithermal and deeper level mesothermal deposits.

In the northern Toodoggone district, AGC Americas Gold Corporation completed 59 drill holes totalling approximately 6100 m on the Finn zone on its **JD** polymetallic gold-silver property, 65 kilometres north of the Kemess South project. Geological resources in the Finn zone (Canada Stockwatch, Feb 4, 1997) were reported at 9 360 000 tonnes grading 1.61 g/t Au. Drilling in 1996 was designed to test known mineralization downdip to the north, below the Finn and Gumbo zones and westerly into the Gumbo zone. Geophysical surveys in the Finn/Gumbo area have outlined an anomaly 1300 m by 2000 m, but drilling has tested an area of about 600 m by 600 m. The Gumbo zone appears to be the up-dip, western extension of the Finn zone. The company now believes they are targeting a structurally-controlled, 600 m by 400 m, east-west trending zone with a central (epithermal-style) brecciated and silicified gold zone, enveloped by a large stockwork zone of quartz-carbonate veining with polymetallic disseminated and massive sulphides. The company postulates that porphyry-style mineralization in the footwall is related to a deep-seated porphyry intrusion, thus suggesting the potential for a much larger, lower grade, bulk mineable deposit. An induced polarization survey completed after this year's drilling defined several new drill targets to both the east and west of the current area of drilling. Further drilling and extensive geophysics is planned for 1997. Calculation of a mineral inventory is underway using various cut-off grades. Metallurgical testing is also planned.

In the Blackwater River area in the Interior Plateau region of central British Columbia, Teck Corporation completed approximately 3365 m of diamond drilling in 23 holes in 1996 on its **Tsacha** epithermal gold-silver vein target. Drilling focussed on veins other than the Tommy vein which has been traced over a strike length of 640 m, an average width of 4 m and to at least 120 m downdip. The Tommy vein and all other vein systems strike north-south and have near-vertical dips. Trenching was also conducted across 2 kilometres of veins in an east-west direction; at least 8 veins have been identified which have the potential to host bonanza-style gold-silver mineralization of the

TABLE 4
1996 EXPLORATION HIGHLIGHTS

Company Name	Project Name	Commodity	Estimated Tonnes (000s)	Estimated Grade	Reference
Massive Sulphide Deposits					
Doromin Res. Ltd./ Westmin Res. Ltd.	Dragon	Cu, Pb, Zn, Ag, Au			
Kenrich Mining Corp.	Corey	Au, Ag, Zn, Pb			
Sultan Minerals Ltd.	Jersey - Emerald	Au, Ag, Zn, Pb			
American Comstock Ltd.	Harper Ck.	Cu, Au, Ag	96 000	0.41% Cu, 0.045 g/t Au 2.5 g/t Ag	
Porphyry (and related) Deposits					
Hera Res. Ltd.	Nak	Cu, Mo, Au	45.4	0.70 % Cu equiv.	Hera, 1996
Getty Copper Corp.	Getty North	Cu	21	0.44% Cu	Getty, 1995
Booker Gold Exploration Ltd.	Hearne Hill	Cu, Au	180	1.7% Cu	Prospectus, 1992
Spokane Res. Ltd./ Rio Algom Ltd.	Mac	Mo, Cu			
Lysander Gold Corp./ Kennecott Canada Inc.	Lorraine	Cu, Au	10 000	0.67% Cu, 0.34 g/t Au	Kennecott, 1993
Big Valley Res. Ltd.	Lloyd-Nordik	Cu, Au	7 190	0.31 % Cu, 0.243 g/t Au.	Big Valley, 1996
Skarn Deposits					
Teck Corp.	Eholt	Cu, Au			
Athlone Res. Ltd. / Vital Pacific Ltd.	Soup	Au			
Vein Deposits					
AGC Americas Gold Corp.	JD-Finn	Au	148	4.4 g/t Au	GCNL, 1995
Teck Corp.	Tsacha	Au, Ag			
Gold City Mining Corp./ International Wayside Mines Ltd./ Mosquito Cons. Gold Mines	Cariboo Gold Quartz - Sanders Zone Rainbow Zone	Au	690 907	3.84 g/t Au 4.53 g/t Au	
Teuton Res. Ltd/ Minvita Enterprises Ltd.	Clone	Au, Ag			

Note: GCNL = George Cross Newsletter.

adularia-sericite type. Drilling also tested the newly discovered Johnny vein (1995), located approximately 600 m west of the Tommy vein, the Barney vein (1996), located east of the Tommy vein near the eastern boundary of the property, and the Larry and Billy veins. In early 1997, Teck released a preliminary resource estimate for the Tommy Vein of 478 600 tonnes, grading 8.7 g/t Au and 82.3 g/t Ag using a 3 g/t Au cutoff. To the east, Phelps Dodge Corporation of Canada Ltd. drill-tested its **Tam/Taken** gold property. The best results were encountered from the Ted vein, which has been traced along strike for 300 m and over an average width of 10m. There is a good possibility that veins on the Tam/Taken and Tsacha properties are all part of the same mineralizing system. Nearby to the northwest, Lucero Resource Corporation conducted a 9-hole diamond drilling program on its **Wolf** epithermal gold prospect.

In the Likely area, Cyprus Canada Inc. under an option agreement with Consolidated Logan Mines Ltd. and Eastfield Resources Ltd. completed approximately 2700 m of trenching in eight trenches across the long axis of the mineralization plus detailed channel sampling and geological mapping on the **Spanish Mountain** (CPW) bulk-mineable gold target. Trenching suggests three zones of mineralization using a cut-off grade of 0.25 g/t Au. Previous exploration had concentrated on the higher-grade auriferous quartz veins; geological resources were estimated in 1994 at 861 650 tonnes grading 1.92 g/t Au. Cyprus examined the widespread occurrence of gold mineralization associated with a shale-siltstone horizon (*i.e.*, 'stratabound') as part of a sequence including intermediate to felsic volcanic and intrusive rocks. Cyprus terminated its option in the fall, as the property does not fall within its corporate criteria.

In the Wells-Barkerville area, famous for both its lode and placer gold production, International Wayside Gold Mines Ltd. conducted a large surface and underground diamond and percussion drilling program on its **Cariboo Gold Quartz** mine. The main objective is to outline a zone of gold vein mineralization in the up-plunge projection of the Rainbow zone, which could be mined by open-pit methods. The 1200 level adit was extensively rehabilitated providing access to the Rainbow zone through to the Sanders zone and Pinkerton zone. Drilling tested these zones along a strike length of approximately 730 m and a width of 120 m, for extension to previously known mineralization, particularly targeting the open-pit potential to a goal of 1 million tonnes grading 4.1 g/t Au. The Huestis zone was discovered in 1996 and occurs between the Rainbow and Sanders zones. Surface exploration was also carried out on the B.C. vein. An airborne

geophysical survey was completed over the property, and a detailed compilation and evaluation of data was completed. The company received approval, but did not proceed, to extract a 9 900-tonne bulk sample for metallurgical testing, as part of its engineering studies leading to a feasibility study in 1997. Currently, the company is examining a proposal for a 1000 tonne-per-day milling operation from an open pit, including the potential of using a vat (heap) leach system to suit a combination of underground and open pit ore.

South of Red Mountain in the Stewart camp, Teuton Resources Corporation and Minvita Enterprises Ltd. conducted a multi-million dollar surface diamond drilling and trenching program on its new **Clone** high-grade gold discovery. Funding was provided by Homestake Canada Inc. and Prime Resources Group; they retain a first right of refusal on the property. Furthermore, Homestake was contracted to provide technical advice. An airborne geophysical survey earlier in the season provided additional targets for drill testing. Diamond drilling in excess of 11 600 m in 95 holes and extensive trenching (140 trenches) tested the main zone and its extension along a 1.5 kilometre strike length and over a width of 60 metres. Two types of high-grade, sub-parallel, shear-controlled (both ductile and brittle deformation types) vein and stockwork complex structures, trending northwesterly and with vertical dips, host gold and gold-cobalt mineralization. The H-type, consisting of pervasive hematite and silica with minor amounts of chalcopyrite, specularite, magnetite and native gold, has a drill-defined strike length of 330 m and depths in excess of 235 metres. Individual veins are up to 7 m wide. The S-type, consisting of pyrite, arsenopyrite, cobalt-bearing mineral(s) and chlorite, have been tested over a strike length of 500 m and depths in excess of 150 metres. Individual veins are up to 6 m. Exploration along strike to the northwest (*i.e.* upslope) identified the Clone Extension, Anderson and Sutton East zones; and along strike to the southeast (*i.e.* downslope) identified a possible extension of mineralization under the ice. In addition, regional prospecting has identified a one kilometre zone with gold-bearing stringer-type mineralization (Sutton West zone) located three kilometres west-northwest of the core Clone area, along its projected strike. A company preliminary resource calculation for the H-1 zone is expected in early 1997.

In the Lillooet area, Homestake Canada Inc. drilled the **Ample/Goldmax** mesothermal gold vein target, located to the east of the historic Bralorne gold camp. Native gold, arsenopyrite and minor pyrite occur in quartz with minor carbonate veins hosted within a shear zone in Lower Cretaceous Brew Group argillites, sandstones and minor greenstone.

North of Lillooet, Stirrup Creek Gold Ltd. conducted further trenching and diamond drilling on Zone V of its **Watson Bar (Second)** (Carlin-type?) gold target. Zone V was extended to a strike length of 80m, with bonanza grades being reported. It hosts a gently southwest-dipping carbonaceous fault zone(s) and subparallel mineralized quartz veins in Cretaceous sedimentary rocks of the Jackass Mountain Group, intruded by Eocene hornblende diorite. The bulk-mineable potential of the property is also of interest to the company. Immediately along strike to the northwest, First Point Capital Corp. conducted geochemical and geological surveys on the Mad epithermal prospect.

West of Port Hardy, First Choice Industries Ltd. conducted a preliminary 10-hole diamond drilling program on its high-sulphidation, gold-enriched **Knob Hill** prospect. A fine-grained sulphide stockwork in brecciated rhyolite was encountered underlying a 800m by 250m gold-arsenic soil geochemical anomaly. A follow-up geophysical survey was also completed.

POLYMETALLIC MASSIVE SULPHIDE DEPOSITS

Base and precious metal rich (sedex, volcanogenic and seafloor hydrothermal) massive sulphide deposits were very important targets in 1996. The success of projects at Myra Falls, Tulsequah Chief/Big Bull, Eskay Creek, and Akie over the past few years testifies to the exploration potential for these deposit types. The discoveries and rapid development on the Wolverine and Kudzu Ze Kaya deposits in the Yukon, hosted within the Yukon-Tanana Terrane, and the successful re-opening of the Greens Creek mine west of Juneau, Alaska are reminders that the rocks which host the deposits project into British Columbia.

On the **Dragon** polymetallic 'Myra Falls-type' prospect, located near Gold River on Vancouver Island, which Westmin Resources Ltd. holds under an option agreement with Doromin Resources Ltd., the company conducted a two-phase program which included geological mapping, geochemical and geophysical surveys and diamond drilling along a 4-km strike length of favourable Myra Formation volcanic rocks, between Muchalat and Norgate rivers. Drilling tested the Norgate Creek zone area, 3.6 km south of the Dragon zone, and a newly discovered area of potential significant mineralization south of Norgate Creek near Leighton Peak.

At the **Hail-Harper Creek** volcanic-hosted, stratabound copper prospect near Clearwater, American Comstock Exploration Ltd., under agreements with MBI Mining Brokers whereby American Comstock

acquired a 100% interest in the project, conducted a 9-hole diamond drilling program designed to increase a previously calculated geologic resource of 96 million tonnes grading 0.41% Cu, 0.045 g/t Au and 2.5g/t Ag. Zones averaging 100 m in thickness with predominantly pyrite and chalcopyrite occur within a quartz-sericite-chlorite alteration zone in rhyolitic rocks of the Eagle Bay Assemblage. The company believes there is good potential to increase resources, particularly down dip to the northwest and along strike to northeast.

At the **Corey** property, 10 kilometres south of the high-grade Eskay Creek gold-silver-zinc-copper mine, Kenrich Mining Corporation drill tested the T.V., Cumberland and Bench zones, during a multi-phase, \$ 1 million exploration program in 1996. A 35-person camp was established on site. In addition, a 1100 km airborne magnetic and radiometric survey was completed. Drilling on the Cumberland prospect identified two zones of massive pyrite, barite and sphalerite, including a new zone of high-grade silver mineralization. The T.V. zone was extensively re-mapped; drilling located a new silver-rich (pyrargarite) portion hosted by black shales, extending the zone to the north and east. The company estimates an increase in the mineral inventory of the T.V. zone from approximately 2180 kilograms (70 000 oz) of gold and 31 100 kilograms (1 million oz) of silver to approximately 3920 kilograms (126 000 oz) of gold and 111 000 kilograms (3.57 million oz) of silver. Three drill holes tested the Bench zone. Regional prospecting resulted in the discovery of several high-grade auriferous quartz veins in the southern portion of the property (*e.g.* Sheellagh Creek showing).

During 1996 Sultan Minerals Inc. conducted a 1610 m surface and 90 m underground drilling program in three zones on its **Jersey-Emerald** stratabound sulphide deposits near Salmo. Underground drilling on the Bismuth gold zone, a flat-lying gold and native bismuth enriched horizon which parallels (and overlies?) the east limb of the Jersey deposit, identified a 9 m intersection of mineralization. Previous drilling suggested that this zone could be greater than 610 m in strike length and up to 18 m in width. Surface drilling on the 2.5 km long Emerald-Leroy gold-tungsten-arsenic anomaly, 1 km along the west limb of the Jersey deposit, identified a second gold-enriched zone over a strike length of 600 m and over narrow widths. Drilling of three surface holes totalling 600 m on the Iron Mountain 2.5 km long by 1.3 km wide copper-zinc-silver soil anomaly, located 1 kilometre east of the Jersey deposit, identified a 160 m thick section of banded, sulphide-rich schist containing pyrite, pyrrhotite, sphalerite and chalcopyrite. The company is examining the large tonnage, open-pit potential of this zone. Regional prospecting and geochemical sampling

extended the favourable strike length of mineralization another three kilometres to the south of Iron Mountain in the Wilson Creek area. The company also added significantly to its land package, by acquiring through option agreements, the Tungsten King, Truman Hill, Leroy North, Summit, Boncher and Jumbo No. 2 properties. Preliminary prospecting on these led to some new discoveries.

SKARN DEPOSITS

In the Greenwood camp, Orvana Minerals Corporation and Teck Corporation entered into a 40/60 joint venture agreement to further explore Orvana's **Eholt** copper-gold skarn target. Drilling tested an area to the northwest of the Rambler showing and a 1.5 km long by 200 to 300 m wide northerly-trending anomaly which extends from the Dead Honda showing.

In north-central British Columbia, Vital Pacific Resources Ltd. (74%) and Athlone Resources Ltd. (16%) drilled 9 diamond drill holes on their **Soup** property. Drilling targeted a northwesterly-trending magnetite-rich, auriferous zone containing at least three stratiform lenses near the base of Takla Group volcanic rocks. Locally, the mineralization has been remobilized and is structurally controlled in cross-cutting fault zones. Geochemical, magnetic and radiometric surveys have outlined mineralization over a total strike length of 2.5 kilometres; the main target area (Saddle Gully zone) and anomalies 1 km to the northwest and southeast were tested. Although drilling problems plagued the project, the company intends to further pursue its open pit, bulk mining potential in 1997.

OTHER TARGETS

Bren-Mar Resources Ltd. completed an aerial magnetic survey and a preliminary short, 5-hole diamond drilling program on its **Turnagain River** nickel, cobalt and copper ultrabasic-hosted deposit, east of Dease Lake.

Gold City Mining Corporation, Phoenix Gold Resources Ltd. and Orion International Minerals Corporation are examining and evaluating the **Old Nick** nickel-cobalt prospect in the Rock Creek area, for its low-grade, bulk tonnage heap-leach potential. The companies believe this unique sulphide deposit, based on historical drilling and trenching, contains approximately 30 million tonnes of near-surface mineral inventory grading 0.22% Ni and 0.015% Co. Previous operators estimated the deposit could contain in excess of 100 million tonnes. During 1996, six diamond drill holes were completed to provide material for a metallurgical testing program, which includes leaching,

solvent extraction and electrowinning. In August an option agreement was signed with Canadian Mine Services Ltd., and Monument Mining Corp. whereby the latter two companies have agreed to finance, further exploration and development in return for an eventual 70% joint venture interest in the property.

High-grade redbed-type copper prospects were re-examined in the Bear Lake and Driftwood Creek areas, north of Smithers.

INITIATIVES IN BRITISH COLUMBIA

Several government programs that influence mineral resource planning, exploration and development in British Columbia were active during 1996.

- The **Prospectors' Assistance Grant Program** is designed to promote grassroots prospecting for new mineral deposits in British Columbia. It contributed up to 75% of eligible costs of an approved project to a maximum of \$10 000. Sixty-eight grants were awarded in 1995 from a budget totalling \$500 000.
- The **Geological Survey Branch** programs focused on regions where significant mineral potential is indicated (Gataga North,, Yukon-Tanana Terrane (B.C.), French Range, Toodoggone Southeast-McConnell, Babine, Sitlika, Northern Selkirks, Tatogga Lake, Kootenay Terrane, Bella Coola and East Kootenays). A project was completed examining the metallogeny of the Rossland Camp; a new project was initiated examining the potential for bulk tonnage gold deposits. Several smaller scale projects were carried out on coal and industrial minerals. Results of these programs are expected to encourage base and precious metal exploration in these areas and elsewhere.
- The **Mineral Potential Mapping Initiative** will see completion of 1:250 000 scale mineral potential maps for the province in 1996, with the last area to be completed being the northwest sector. These data are being used in many land-use decisions.
- An inventory of **sand** and **gravel** resources was carried out and will assist the Ministry in managing the aggregate resources in the province.
- The Federal-Provincial **B.C. Geoscience Co-ordinating Committee** continued close liaison regarding the implementation of geoscience programs of the Geological Survey of Canada and the British Columbia Geological Survey Branch.
- A second open file on the "**Mineral Deposit Profiles**" was published. This brings the total to 60 published metallic deposit types. Short courses on parts of the project were delivered at Cordilleran Roundup 1996

(Vancouver) and the Northwest Mining Association Conference 1996 (Spokane, Wa.).

- The **National Geoscience Accord**, which strengthens the federal-provincial geoscience activities in a collaborative manner, was signed in 1996.
- Discussion continued with the **First Nations**, spearheaded through the Treaty Commissions in British Columbia, designed to provide them with a more equitable role in mineral exploration and development decision making within their traditional territories.
- The Nechako Plateau-Babine Porphyry Belt **NATMAP** program by the Geological Survey Branch and the Geological Survey of Canada in the Nechako River (93F), Fort Fraser (93K) and parts of the Smithers (93L) and Prince George (93G) map areas was in full swing, as part of a five-year project.
- The results of the East Kootenay multi-parameter **airborne geophysical survey**, funded by the provincial government covering two blocks surveyed in 1995, were released on July 11, 1996; a third block (Yahk-Creston) was flown in the fall of 1996 and the results will be released in 1997. Several new claims were staked, primarily targeting Sullivan-type targets.
- The release of **Regional Geochemical Survey** (RGS) data of the Cry Lake (104I) map sheet on July 4, 1996 resulted in numerous claims being staked. During the summer of 1996, similar surveys were completed in the Toodogone River (94E) and McConnell Lakes (94D) map sheets; results will be released in the early summer of 1997.
- The Ministry continued working on a comprehensive review of mineral exploration practices and permitting procedures to develop standards compatible with the Forest Practices Code. The new **Mineral Exploration Code** is expected to be adopted in early 1997.
- The Ministry participated in an interagency study concerning **placer mining** in the province.

SUMMARY AND OUTLOOK FOR 1997

Although an upswing in the mining industry occurred in 1995, the very low level of grassroots or generative expenditures (*i.e.* 12%) in 1996 is of concern now and for the future. The **Golden Bear** and **Bralorne** projects are expected to come on stream in 1997. Three large, open-pit deposits (**Kemess South**, **Huckleberry** and **Mount Polley**) are under construction, with capital costs estimated at \$650 million. The latter two are scheduled for production by the fall of 1997; Kemess South is scheduled for the second quarter of 1998. Successful exploration and development projects at several mines have increased reserves and mine life

(*e.g.* **Myra Falls**, **Highland Valley Copper**, **Snip**, **Eskay Creek**, **Table Mountain**, **QR**, **Gibraltar**, **Premier** and **Similco**). The potential for smaller projects (*e.g.*, **Brett**, **Pellaire**, **Lexington**, **Skinner**), utilizing custom milling facilities will be important in the future. Productivity from southeastern coal mines increased again in 1996, with the strong demand for metallurgical coal. Several major expansions completed in 1995 bode well for the future of these operations (*e.g.* **Quinsam**, **Fording River**, **Greenhills**, **Line Creek** and **Coal Mountain**). Also, significant exploration expenditures occurred on the **Telkwa**, **Willow Creek** and **Tsable River** advanced coal projects; these should enter the development phase in 1997. Four mines (**Goldstream**, **Premier**, **Nickel Plate** and **Similco**) closed in 1996; there were no new mines.

Solid mineral production, estimated at \$3.05 billion, represents about a 12% decrease from 1995 and equates back to pre-1990s values, with the significant exception of 1995. The total metals output was down about 24%. The price of copper is expected to rise slightly in 1997 from its relatively low levels in 1996. Copper production in B.C. during 1997 will decrease as a result of the closure of the **Similco** mine and the pending closure of the **Ajax** mine. Although exploration expenditures, estimated at \$100 million in 1996, represent a 20% increase from 1995, much of the increase can be attributed to significant expenditures at mine sites and advanced and/or development projects (*i.e.* both accounting for 88% of total expenditures). Projects with expenditures in excess of \$500 000 accounted for approximately 72% of the total expenditures; projects with budgets over \$1 million accounted for 57% alone. Claim staking increased by 15%, in part due to the releases of RGS data for the **Cry Lake** (104I) area, and of airborne geophysical data for the **East Kootenay** region. The release of RGS data for the **Toodogone River** (94E) and **McConnell Lakes** (94D) map sheets and additional airborne geophysical data for the **East Kootenay** region should help maintain the current level of new mineral tenure recordings. The number of advanced projects in the Environmental Assessment Process is expected to decrease in 1997.

The many copper and gold-bearing porphyry deposits discovered during the 1960s and 1970s (*e.g.*, **Red Chris**, **Lorraine**) will continue to be explored and developed. Renewed interest in these deposits is indicated by the large program conducted on the **Mac molybdenum-copper** project in 1996. Sedex (*e.g.*, **Akie**) and volcanogenic polymetallic sulphide (*e.g.*, **Tulsequah Chief/Big Bull** and the recent **Wolverine** discovery in Yukon-Tanana Terrane rocks) deposits offer small to medium tonnage and high-grade potential, particularly those enriched in precious metals. The

stratiform, gold-enriched (seafloor hydrothermal) **Eskay Creek** - type deposits are examples of low-tonnage, but potentially extremely profitable, high-grade targets. The transitional setting, which includes vein and skarn deposits related to porphyry systems (*e.g.*, **Red Mountain, Willoughby, Snip, Midway**), offers similar small to medium tonnage and high-grade potential.

The potential for bulk-mineable (heap-leachable) gold deposits will continue to be examined. Future developments at the **Golden Bear** mine will focus on the “no seeum” (Carlin-type) gold mineralization hosted in the carbonate complex. In the Cassiar camp, the **Taurus** property will continue to be explored for its bulk-mineable potential. In the **Keen Creek** silver camp near Kaslo, the potential for a bulk-mining operation will be investigated.

The future development proposals in the **Iskut River** area, such as a road link between the Eskay Creek mine and the Snip mine and the possibility of constructing a mill on-site at the Eskay Creek mine, will continue to assist exploration and development of other properties in the region.

In general, the long-term outlook for mineral markets is very good throughout the Pacific Rim; British Columbia is well positioned to compete.

ACKNOWLEDGMENTS

This report has benefited from information provided by the Regional Geologists with the Regional Operations, Health and Safety Branch, based in five offices throughout the province. They are: Paul Wojdak in Smithers, Bob Lane in Prince George, Mike Cathro in Kamloops, Paul Wilton in Cranbrook and Robert Pinsent in Vancouver. Dan Hora and Barry Ryan, both with the Geological Survey Branch in Victoria, provided summary information on industrial minerals and coal, respectively. Klaus Brueckl, of the Resource Policy Branch in Victoria, provided mineral production statistics. Mineral tenure statistics were provided by Janice Chan and Paul Hagen of the Mineral Titles Branch in Victoria. Marjorie Hunter and Darcy Wiedner, both with the Geological Survey Branch in Vancouver, produced the maps and graphs and typed the manuscript, respectively. Gib McArthur and Ron Smyth provided careful and critical reviews of the manuscript. Janet Holland’s work on the layout and typesetting, and her efforts to ensure that all last-minute changes and revisions were included, are greatly appreciated.

The Ministry appreciates the contributions of data by the exploration and mining community in British Columbia.

MINE AND EXPLORATION HIGHLIGHTS NORTHWEST BRITISH COLUMBIA - 1996

By Paul Wojdak
Regional Geologist

OVERVIEW

Three gold mines operated through 1996. The Eskay Creek, Snip and Table Mountain mines produced approximately 11,085 kilograms of gold. Eskay Creek also produced some 375,000 kilograms of silver. Estimated value is \$250 million (Cdn) and direct employment is about 390. The Endako molybdenum mine continued in full operation employing about 265 people. Premier Gold mine shut down in April but construction of the Huckleberry open pit mine began in June. British Columbia's first gold heap leach pad was prepared for operation at Golden Bear mine where operations are expected to resume in 1997. Eskay Creek mine plans to build a flotation mill.

Exploration in northwest British Columbia continued to focus on advanced projects. Total expenditures rose to \$49.3 million. Total drilling

increased 40 per cent from 1995 to 213,200 metres. Increases from 1995 can be attributed largely to reactivation of the Red Mountain project and an administrative change that has brought Queen Charlotte Islands (and the Harmony project) into the northwest region, while the Toadoggonne camp was shifted to Prince George. Mineral tenure in northwest region rose by 4800 units in 1996, i.e. 4800 more claim units were staked than were forfeited. During each of the previous two years mineral tenure declined by about 2300 units. (There was no claim compilation prior to 1994.) The most significant mine and exploration developments in 1996 are:

- construction of the \$137 million Huckleberry open pit copper mine
- delineation of additional gold-silver ore reserves at Eskay Creek and proposal to build a flotation mill

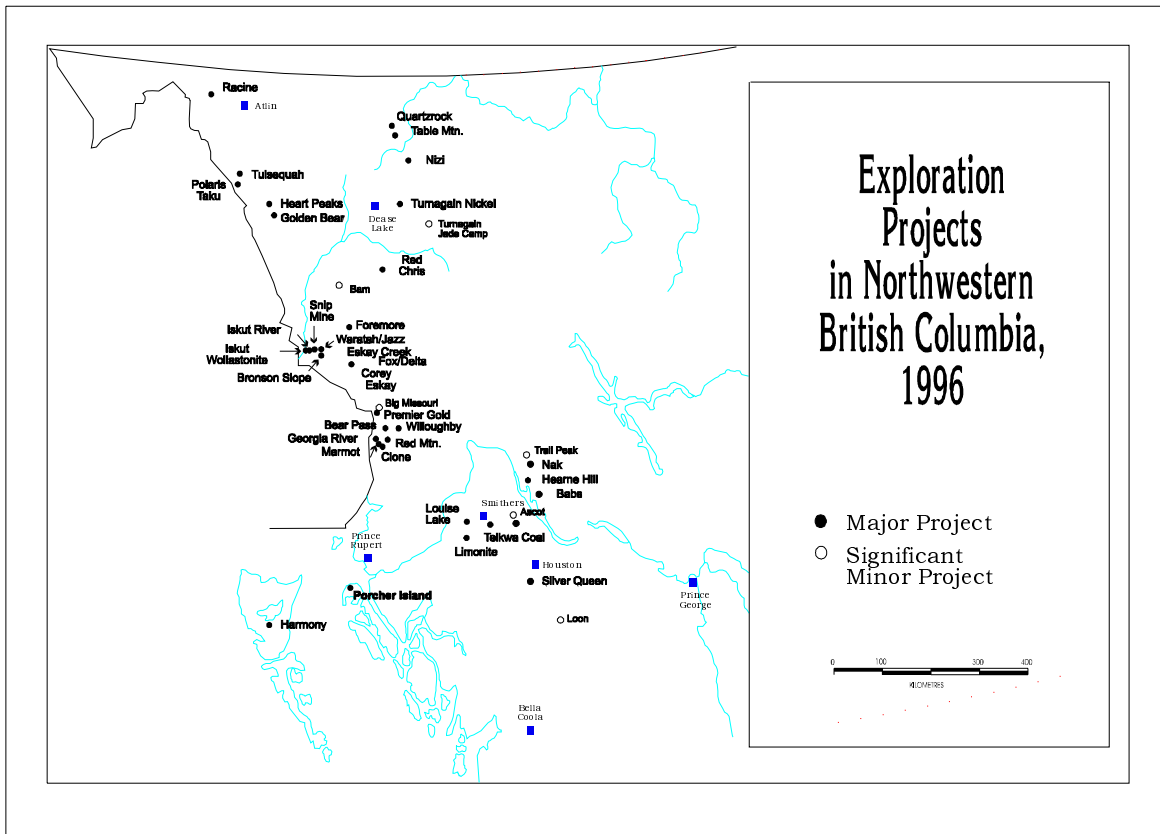


Figure 1. Location map, exploration projects in northwest British Columbia, 1996.

- installation of a heap leach pad to treat gold ore at Golden Bear mine
- pending sale of the Endako open pit molybdenum mine and Premier Gold mine
- development proposal for an open pit coal mine at Telkwa, based on the new Tenas deposit a major underground rehabilitation and definition drilling program at New Polaris (formerly Polaris Taku gold mine)
- renewed exploration of the Red Mountain gold property
- reassessment of the Specogna gold deposit on the Harmony (formerly Cinola) property
- exploration of an unusual gold-cobalt prospect on the Clone property near Stewart
- release of the Cry Lake regional geochemical survey and related claim staking
- lack of exploration on the Red Chris copper-gold prospect

Table 1 lists the 37 projects with expenditures in excess of \$200,000 (compared to 26 projects in 1995) and their locations are shown in Figure 1. Thirteen projects had budgets in excess of one million dollars. Ten of these top 13 projects were carried out by junior companies. Gold targets received 62% of the \$49.3 million in exploration spending. Gold deposit targets include epithermal veins 18%, porphyry-related systems 17.5%, shear veins 12%, mesothermal veins 9.5%, Carlin-type 3.5% and gold skarns 1.5% of exploration dollars. Porphyry copper-gold exploration decreased from 1995 to 15.5% but massive sulphide exploration, primarily for the Eskay (epithermal) sub-type, increased to 14.5% of exploration dollars. The remainder is a diverse group of coal, industrial mineral, nickel and jade projects representing 8% of total expenditures.

Information contained in this report is derived from property visits by the Regional Geologist, news releases, other company reports and, most importantly, from mine and exploration geologists whose work and ideas are acknowledged throughout the text. However, any errors or omissions are the responsibility of the author. The assistance of D. Hanson and D. Flynn in the Smithers office is acknowledged and appreciated.

EXPLORATION TRENDS

Mineral exploration expenditures in northwest British Columbia increased 60% to \$49.3 million in 1996 (Figure 2). There were 255 mineral Notices of Work of which 143 represent minor exploration

projects and 37 were major projects (more than \$200,000 expenditure). Of the remainder, at least 18 programs were not carried out, 10 were filed only for

reclamation and 47 were second (or more) notices on a project.

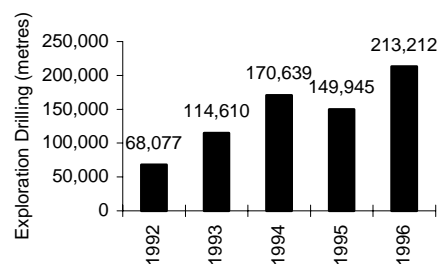


Figure 2. Mineral exploration expenditures in northwest British Columbia.

Total exploration drilling rose to 213,212 metres in 1996 (Figure 3) reflecting the increase in large drill programs on intermediate and advanced projects in the region. Insight into activity at the grassroots level of the exploration industry is given by the number of claims staked and the number forfeited. There were 12,726 mineral claim units recorded, an increase of 11 per cent over 1995, and 7,929 claim units forfeited, 42 per cent less than the previous year. Table 2 summarizes the results by mining division. In Atlin, Liard and Skeena there were more claim units staked than forfeited but in Omineca forfeitures outnumbered new claims. In Liard mining division there was a marked decrease in forfeitures and staking increased. After two years of diminished mineral tenure the gain in 1996 suggests a revival in grassroots exploration in northwest British Columbia. New placer claims amounted to 166 units, about one-half of 1995. There were 154 forfeitures giving a net gain of 12 units. Atlin mining division recorded the greatest increase in placer tenure whereas Omineca had the most forfeitures.

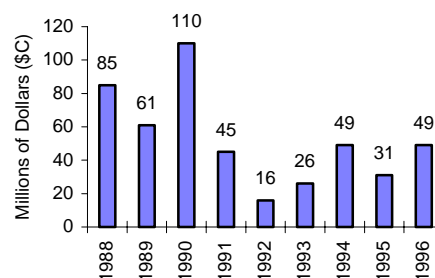


Figure 3. Exploration drilling in the Northwest Region

The strong emphasis of exploration spending on gold continues. Work on deposits in which gold is the only important commodity increased from 54% in 1995 to 62% in 1996. The actual figure is considerably

TABLE 1. MAJOR MINERAL EXPLORATION PROJECTS (>\$200,000) IN NORTHWEST REGION, B.C.

<u>PROPERTY</u>	<u>OPERATOR</u>	<u>MINFILE</u>	<u>NTS</u>	<u>COMMODITY</u>	<u>TYPE</u>	<u>WORK DONE</u>
Babs	Pacific Sentinel Gold Corp.	093L 220	93L/16	Cu, Au	Porphyry	IP & Mag, 30 km; 6 ddh, 838 m
Bear Pass	International Tournigan Corp.	104A 063, 066	104A/4	Au, Cu, Ag	Iron formation	Air Mag; 11 ddh, 1362 m
Bronson Slope	International Skyline Gold Corp.	104B 077	104B/11	Au, Cu	Porphyry	14 ddh, 3428 m; Environmental & geotechnical studies
Burbridge Lk	D. Groot Logging Ltd.	093L 223	93L/10	Cu, Mo	Porphyry, Vein	IP, 35 km; 10 ddh, 1829 m
Clone	Teuton Resources Corp.	103P 251	103P/13	Au, Co	Shear vein	Geol; Geochem; Air EM; 140 rock trenches; 95 ddh, 11 577 m
Corey	Kenrich Mining Corp.	104B 011	104B/8	Au, Ag	Epithermal massive sulphide	Geol; Geochem; Air Mag & Radiometrics, 1100 km; Trench, 300 m; 29 ddh, 3 000 m
Eskay Creek	Homestake Canada Inc.	104B 008	104B/9	Au, Ag, Cu, Zn	Epithermal massive sulphide	Geol; Drill access, 200 m; 113 ddh, 20 000 m
Eskay	Canamera Geological Ltd		104B/9, 10	Au, Ag	Epithermal massive sulphide	Geol; Geochem, 20 km; UTEM, 13 km
Foremore	Cominco Limited	104G 148	104G/2	Zn, Cu, Pb, Ag, Au	VMS	1 ddh, 663 m
Fox/ Delta	Geofine Exploration Consultants Ltd.	104A 004, 165, 166	104A/12	Au, Ag, Cu	Porphyry-like gold	Geol; Geochem; 5 ddh, 1196m
Georgia River	Aquaterre Mineral Development Ltd.	103O 013	103O/9	Au	Vein	16 ddh, 1828 m
Golden Bear	North American Metals Corp.	104K 087	104K/1	Au	Carlin	HLEM, 17 km; Geochem; Trench, 1300 m; 23 ddh, 2510 m; 82 R/Cdh, 3517 m;
Harmony	Misty Mountain Gold Limited	103F 034	103F/9	Au	Epithermal	Drill access, 800m; 116 ddh, 27 515 m
Hearne Hill	Booker Gold Explorations Ltd.	93M 006	93M/1	Cu, Au	Porphyry	Access road, 4 km; Geochem; IP, 6 km; Drill access, 1300 m; 40 ddh, 10,000 m
Heart Peaks	Canamera Geological Ltd.	104K 084	104K/9	Au, Ag	Low sulfidation epithermal	Geol; Geochem; IP & Mag 2 km; 2 ddh, 786 m
Iskut River	Gamah International Limited	104B 312	104B/11	Au	Shear Vein	14 ddh, 1894 m
Isk Wollastonite	Super Twins Resources Ltd.	104B 123	104B/11	Wollastonite	Skarn	Geol; 22 ddh, 1980 m; Legal survey; Environmental, terrain & pipeline studies
Limonite	Telkwa Gold Corp.	093L 075	93L/12	Au, Ag, Cu	High sulfidation epithermal	Geol; 3 ddh, 863 m
Louise Lake	Global Mineral and Chemical Ltd.	093L 079	93L/13	Cu, Au	Porphyry	5 ddh, 1128 m
Marmot	Navarre Resource Corp.	103P 103	103P/13	Zn, Cu, Au	Vein	19 ddh, 1402 m
Nak	Hera Resources Inc.	093M 010	93M/1,8	Cu, Au	Porphyry	27 ddh, 5480 m
Nizi	Madrona Mining Limited	104I 032	104I/14, 15	Au, Ag, Zn, barite	Epithermal	6 ddh, 914 m
Polaris Taku	Canarc Resource Corp.	104K 003	104K/12	Au	Mesothermal vein	Rehabilitate AJ level; Open Polaris portal; 24 U/g ddh, 3210 m
Porcher Island	Porcher Island Gold Corp.	103J 017	103J/12	Au	Mesothermal vein	Geol; VLF, 10 km; 13 ddh, 2070 m
Premier Gold	Westmin Resources Limited	104B 054	104B/1	Au, Ag, Zn	Epithermal vein	192 U/g ddh, 15,132 m
Quartzrock	Cyprus Canada Inc./ International Taurus Resources Inc.	104P 010, 011, 012	104P/5	Au	Greenstone gold ("Cassiar" type)	Drill access, 1100 m; 8 trenches, 2400 m; 17 ddh, 2039 m; 36 R/C dh, 3869 m
Racine	Westmin Resources Limited	104M 048, 049, 050	104M/10	Au, Ag, Co	Skarn	Geol; 6 ddh, 691 m

<u>PROPERTY</u>	<u>OPERATOR</u>	<u>MINFILE</u>	<u>NTS</u>	<u>COMMODITY</u>	<u>TYPE</u>	<u>WORK DONE</u>
Red Chris	American Bullion Minerals Limited	104H 005	104H/12	Cu, Au	Porphyry	Environmental studies
Red Mountain	Royal Oak Mines Inc.	103P 086	103P/13	Au, Ag	Porphyry-like gold	Radar, 5km; U/g development, 302 m; 60 Sfc and U/g ddh, 26,967 m
Silver Queen	Kettle River Resources Ltd.	93L 002, 162, 216	93L/2	Au, Ag, Zn	Polymetallic vein	Max-Min, 15 km; 10 ddh, 1830 m
Snip Mine	Homestake Canada Inc.	104B 004, 264	104B/11	Au	Shear vein	U/g development, 600m; 93 U/g ddh, 9500 m; Drill access, 2 km; 34 Sfc ddh, 8,200 m
Table Mountain	Cusac Gold Mines Ltd.	104P 070	104P/4	Au	Greenstone gold ("Cassiar" type)	139 Sfc and U/g ddh, 10150 m
Telkwa South	Manalta Coal Ltd.	93L 156	93L/11	Coal	Thermal coal	155 Rotary dh, 16340 m; 18 ddh, 275 m; bulk sample, 80 tonnes; ARD study
Tulsequah	Redfern Resources Ltd.	104K 002	104K/12	Cu, Zn, Pb, Ag, Au	VMS	Environmental studies; Bulk sample & Met test, 4 tonne
Turnagain Nickel	Bren-Mar Resources Ltd.	104I 014,119, 120	104I/7	Ni, Co, Cu, PGE	Magmatic	Air Mag, 40 sq. km; 5 ddh, 793 m
Waratah/Jazz	Maple Mark International	104B 204, 296	104B/10	Au	Shear Vein	Geol; VLF/ Mag, 4.5 km; 8 rock trenches
Willoughby	Camnor Resources Ltd.	103P 006	103P/13	Au	Porphyry-like gold	U/g development, 45 m; 30 U/g ddh, 2383 m; 31 Sfc ddh, 3459 m

TABLE 2. SUMMARY OF CHANGES IN MINERAL TENURE, NORTHWEST REGION, B.C.

	1994		1995		1996	
	STAKED	FORFEIT	STAKED	FORFEIT	STAKED	FORFEIT
Atlin	455	-1,762	531	-2,142	767	-633
Liard	1,332	-4,893	4,022	-6,371	5,475	-1,794
Omineca	1,981	-2,935	4,358	-1,867	2,829	-3,878
Skeena	<u>6,007</u>	<u>-2,541</u>	<u>2,543</u>	<u>-3,363</u>	<u>3,655</u>	<u>-1,624</u>
TOTAL	9,775	-12,131	11,454	-13,743	12,726	-7,929
NET GAIN OR LOSS		-2,356 units		-2,289 units		+4,797 units

higher if exploration for precious metal enriched (Eskay-type) massive sulphide and porphyry copper-gold is included. Activity continues to focus on or near known deposits such as Harmony, Polaris Taku, Quartzrock (Taurus), Snip and Eskay Creek. Running counter to this pattern is an apparent revival of interest in base metal deposits at the grassroots level, inferred from claim staking data particularly in the area between Kutcho Creek, Cassiar, Gataga and Watson Lake. This may translate into increased exploration spending on base metal targets in 1997. Acquisition of the Midway zinc-lead-silver manto deposit by Imperial Metals Corporation tends to confirm this trend. Contributing factors to a base metal revival are release of regional geochemical surveys in the Gataga and Cry Lake areas by B.C. Geological Survey and discovery of the rich Wolverine and Kudz Ze Kayah deposits in Yukon. The level of interest in porphyry copper-gold deposits in Northwest region remained steady in 1996, as judged by spending and staking data.

OPERATING MINES

ENDAKO MINE

Endako is a 30,000 tonne per day open pit molybdenum mine owned and operated by Placer Dome Canada Limited. Since production began in 1965 Endako has yielded approximately 160,000 tonnes of molybdenum metal. The deposit is within the Cretaceous Francois Lake batholith, a multiphase intrusion of granite, quartz monzonite and alaskite that intrudes the accretionary boundary between Cache Creek and Stikine terranes. A quartz-molybdenite vein stockwork occurs in a 3 km easterly elongate zone within the early, coarse grained Endako quartz monzonite, domed by emplacement of the late Casey alaskite. Pre-ore granite to alaskite dikes fill northeast faults and are cut by molybdenite veins. The ore zone lies in the hanging wall of the north dipping South Boundary fault, the principal ore controlling structure. Other faults and dilational molybdenite veins splay from

it in horsetail fashion. The mine comprises three pits, the 1.7 km long Endako pit from which all ore is currently produced, the much smaller and mined out Denak East pit and the partially developed Denak West pit. Unofficial reserves are about 100 million tonnes at 0.126% MoS₂, sufficient for 10 years of production. Mine cut off grade is 0.07% MoS₂. In late 1996 Placer Dome declared its intent to sell Endako but at time of writing no agreement had been reached. Induced polarization surveys were conducted east and west of the open pits but the mine sale decision curtailed plans to drill test anomalous areas. Also curtailed were plans to drill the southeast end of the Endako pit at depth to evaluate pit expansion.

ESKAY CREEK MINE

The Eskay Creek mine is owned by Prime Resources Group Inc. and operated by Homestake Canada Inc. Ore is mined at 270 tonnes per day and shipped directly to smelters in Japan and eastern Canada, there is no milling on site. The Eskay Creek deposit is a gold-silver enriched exhalative massive sulphide formed at the contact between rhyolite and overlying mudstone near the top of the Lower to Middle Jurassic Hazelton Group. The 21B deposit lies on the north flank of an endogenous rhyolite dome. Sphalerite, tetrahedrite, lead sulphosalts, galena and pyrite were transported northerly from a hydrothermal vent as clastic density flows and deposited as interbeds in mudstone. In addition to precious metals, the deposit is enriched in deleterious elements; mercury, antimony and arsenic. Mercury correlates closely with gold and a prime requirement of grade control is to maintain mercury content of ore shipments to less than 1200 ppm by ore blending. Poor rock quality necessitates mining by 2.4 m wide drift-and-fill stopes using cemented river gravel as ground support. Mine output in 1996 was 211,276 ounces (6570 kgm) of gold and 12,054,161 ounces (375,000 kgm) of silver. Cost of production, including shipping and smelting is U.S \$170 per ounce of gold equivalent. Exploration drilling found 97,000 tonnes of 130 gm/t of gold equivalent, thereby replacing ore mined during 1996. Reserves of direct shipping ore remain unchanged at about 1.08 million tonnes at 65.5 g/t Au, 2930 g/t Ag, 0.77% Cu and 5.6% Zn. More significantly, continued exploration drilling on the northeast extension (NEX) of the 21B deposit and in the 109 footwall zones located a total of 235,000 tonnes at an average grade of 34.1 g/t of gold equivalent. Like the 206,000 tonnes of 30.1 g/t Au and 1921 g/t Ag found in the NEX zone in 1995, these new reserves are low in deleterious elements and amenable to conventional milling. Homestake's decision to build a flotation mill

at Eskay Creek is an important development in the Iskut camp.

SNIP MINE

On April 30 Cominco Ltd. sold its 60% interest in the Snip gold mine to Prime Resources Group Inc. for \$55 million, giving that company 100% ownership of the operation. Homestake Canada Inc. is the mine operator. The main orebody at Snip is the Twin zone, a 0.5-15 m wide quartz-carbonate-sulphide vein in a shear zone within biotite hornfels greywacke 1000 m from the Red Bluff granodiorite porphyry. The shear is a normal fault with 28° oblique slip. The Twin zone owes its name to a post-ore biotite lamprophyre dike which lies in the plane of the ore vein and commonly segments the vein in two. The Twin vein extends 1000 m along strike and 500 m vertically with a steep northwest plunge. Since mining began in 1991 most of the Twin zone has been extracted and an increasing proportion of ore is derived from the ore zone fringe. Consequently, production from mechanized stopes has diminished and reliance on conventional cut and fill stopes has increased. This combined with a change in work schedule necessitated a 35% increase in work force in 1996 and a decrease in ore production from 460 to 430 tonnes per day. Recovery of the rich crown pillar began in 1995 and continued during favourable summer weather in 1996. Exploration for new ore zones intensified in 1995 and late in the year the 150 portal was collared to evaluate the newly discovered Twin West zone. If Twin West is correlative with the Twin zone it has been displaced about 300 m south (left) by the Monsoon Lake structure. Underground development (600 m) on Twin West was completed in 1996. Surface and underground drilling outlined 36,500 tonnes grading 19.9 g/t Au early in 1996. Step out drilling on a 20 m grid was largely disappointing until late in the year when drilling encountered what may prove to be a new oreshoot.

Snip produced about 3840 kgm (123,589 ounces) of gold in 1996 as gold dore and concentrate. The concentrate was treated at the Premier Gold CIL mill until gold recovery became unsatisfactory. In the third quarter Snip began to ship its concentrate along with Eskay ore to the DOWA smelter in Japan. Total production cost under new management in the second half of 1996 was U.S. \$163 per ounce, including shipping and refining. Homestake has applied to Ministry of Forests for a Special Use Permit to build an extension of the Iskut road to Snip mine. This would reduce operating costs thereby extending mine life by enabling lower grade ore to be mined (the current cut-off grade is 12 g/t Au). Proven and probable reserves at the beginning of 1997 in the Twin zone, 150 and 130

footwall veins and new Twin West zone are 334,899 tonnes at 24.77 g/t Au, sufficient to mid 1999.

PREMIER GOLD MINE

Premier Gold mine, owned and operated by Westmin Resources Limited, ceased operations in April. During the third quarter Premier Gold stopped treating Snip concentrate due to unsatisfactory gold recovery arising from a change in concentrate mineralogy. Gold-silver ore at Premier consists of a series of epithermal quartz-feldspar-calcite veins that exhibit pronounced vertical zoning over a range of 300 m from rich gold-silver ore near surface to base metal-gold ore at depth. The veins are related to sanidine porphyry dikes, high level apophyses of the early Jurassic Texas Creek granodiorite stock which intrudes coeval Hazelton Group andesite. Premier was a rich gold-silver producer from 1919 until 1963 and was re-opened as an open pit mine by Westmin Resources in 1989. In the first quarter of 1996 the mine produced about 700 tonnes per day of gold-silver ore from a combination of caved stopes below the open pit and in-situ ore from deeper in the vein system. Following closure, detailed diamond drilling commenced with the objective of finding a three year ore supply (about 550,000 tonnes of 7 g/t Au) that would provide a basis for development of a more efficient system of moving ore from below 4-level to the mill, and perhaps add a zinc recovery circuit (ore below 4-level contains about 2% Zn). The first phase of drilling outlined proven and probable reserves of 350,000 tonnes at 7.2 g/t Au and 37 g/t Ag with an additional 111,600 tonnes of possible ore at 8.6 g/t Au and 27 g/t Ag. In December Westmin Resources announced its intention to sell the Premier Gold mine and CIL mill.

TABLE MOUNTAIN MINE

Cusac Gold Mines Ltd. experienced its most successful year at the Table Mountain mine in 1996. A total of 24,365 tonnes were mined from which 675 kgm (21,700 ounces) were recovered at a cost of Cdn. \$207 per ounce through the first nine months. The mill operated most of the year at an average rate of 90 tonnes per day. Gold ore on the Table Mountain property occurs in high angle 070° fracture veins in basalt or listwanite below an important thrust fault. Ore shoots are restricted to within a few tens of metres of the overlying argillite which did not sustain fractures and was largely impermeable to gold-bearing fluids. Gold ore shoots within the 1-3 m wide quartz veins are typically 100 m long by 40 m in dip length. Gold grade correlates with total sulphide content and visible gold is common, about 50% of the gold is recovered on site by

gravity separation and the remainder as a sulphide concentrate. In 1996 ore from the Michelle high grade zone and nearby Lily vein, accessed by the Cusac decline, were largely mined out. Exploration of the Melissa vein was unsuccessful. Development of the 2.4 km long 10-level adit was suspended. Its completion is important to future mine development because operating costs will be lower and ventilation and drainage problems alleviated. After milling a small stockpile of ore from the Vollaug vein that had been mined in 1987, ore reserves were identified from mine records and the reclaimed Vollaug 5700 level and 4900 level adits were re-opened. Vollaug is unlike other ore veins at Table Mountain; it is a gently dipping conformable vein in argillite above the thrust fault and the ore is cryptic, there is no visible gold nor can grade be estimated from sparse content of pyrite and tetrahedrite. Vollaug ore contains abundant graphite as chips, ribbons and stylolites in quartz. In November Vollaug reserves were estimated at 39,400 tonnes at 15.6 g/t Au.

MINERAL EXPLORATION

BABINE CAMP

Exploration for porphyry copper deposits related to an early Tertiary magmatic arc continued in the Babine camp. Mineralization is associated with biotite feldspar porphyritic granodiorite stocks or dikes. Hera Resources Inc. conducted preliminary work at Trail Peak and continued drilling on the Nak prospect 35 km north of Bell Copper mine, an important past producer in the district. The zone of porphyry mineralization at Nak is 2.5 kilometres in diameter. Chalcopyrite and bornite occur in a weak to moderate stockwork associated with strong and extensive tourmaline, secondary biotite and common argillic alteration. An IP survey at Trail Peak 15 km further north, delineated a zone of high chargeability with a low chargeability core that will be explored by drilling in 1997. Trail Peak was explored with bulldozer trenches by Texasgulf Sulphur Company in 1968.

At Hearne Hill, 20 km northwest of Bell Copper, Booker Gold Explorations Limited continued drilling for breccia zones within northeast trending, argillic altered biotite-feldspar porphyry dikes and adjacent biotite hornfelsed Hazelton Group volcanic rocks. Two breccias are known, the Chapman and Peter Bland zones. Both are healed by chalcopyrite and bornite. The zones are small, a few tens of metres in surface dimensions but have been drilled to 300 metre depth.

The Northern Dynasty Minerals Ltd - Pacific Sentinel Gold Corp. joint venture completed further IP and magnetic surveys and drilled six more holes on the Babs property, 15 km southwest of Bell Copper, without finding the source of mineralized boulders. The boulder train is underlain by rhyolite in which potassium feldspar is replaced by chalcopyrite. The rhyolite is thought to be correlative to Babine eruptive rocks exposed on the Newman peninsula south of Bell Copper.

Teck Corporation conducted preliminary ground surveys on its Babine camp properties (OFM, HC, Wedge, Bab, Cabin and GC claims) to follow up the airborne EM, magnetic and radiometric surveys conducted in late 1995. Lucero Resource Corp. carried out an airborne EM and magnetic survey over its Nak and Tak claims (not to be confused with Hera Resource's Nak property). Cominco Limited carried out a 40 kilometre IP survey and geological mapping on the overburden covered Hautete claims but did not detect anomalies, nor locate significant mineralization and relinquished its option.

TAHTSA CAMP, HOUSTON AREA

Construction by Huckleberry Mines Limited of the Huckleberry open pit copper mine 85 km south of Houston began in June. Poor weather during the second half of the year resulted in difficult construction conditions but by the end of 1996 a new access connector road was complete; the mill building was enclosed so that inside work can continue through the winter; and the tailings dam was completed to a point that sufficient water can be impounded to operate the mill in the fall of 1997. One-half of the \$137 million capital cost was expended in 1996. Start-up of the 15,500 tonne per day operation is scheduled for late 1997.

Kettle River Resources and New Nadina Explorations Ltd. conducted a Max-Min EM survey and drilled ten core holes south of underground workings at Silver Queen, 35 km south of Houston. Silver Queen is an epithermal, fault-controlled quartz-carbonate-barite vein system mineralized with base metals (mainly zinc) and precious metals (primarily silver). The prospect was explored over several decades and mined during 1972-1973 but complex mineralogy resulted in poor silver recovery. The property is underlain by fragmental dacite to andesite that may be correlative with the Kasalka Group. Current interest is focused on a large alteration zone south of the known polymetallic veins where infrared spectrometry of clay minerals suggests higher alteration temperatures which are regarded as more favourable for gold deposition.

The Fen property 30 km southwest of Houston, also has a long history of exploration. In the 1960's regional silt and follow-up soil geochemistry led to discovery of a glacial boulder in an overburden covered area consisting of massive pyrite-galena-sphalerite-chalcopyrite with significant silver and gold. In subsequent years a variety of geophysical surveys and drilling campaigns has identified weak stockwork base metal mineralization in felsic volcanic rocks but no massive mineralization in bedrock. After a decade of dormancy Consolidated Samarkand Resources Inc. prepared a large grid and began a Genie EM survey in 1996.

NECHAKO PLATEAU

Hudson Bay Exploration & Development Co. Ltd. drilled six holes on the Loon epithermal prospect, 65 km south of Burns Lake. Chalcedonic quartz with sparse pyrite, marcasite, galena and sphalerite is exposed by trenches in altered and brecciated rhyolite of the early Tertiary Ootsa Group. Drilling in 1994 tested a zone of anomalous IP response 25 m below surface. Drilling in 1996 targeted the geophysical anomaly at 150 m depth where it coincides with an interpreted northwest structure. All holes passed through clay-silica into chlorite altered rhyolite, and then into fresh andesite without locating significant precious metal mineralization (V. Van Damme, p. comm).

SMITHERS CAMP

Manalta Coal Ltd. continued intensive drilling on the Telkwa coal prospect, 10 km southwest of Telkwa. A total of 91 infill rotary and core holes were drilled in the Tenas Creek deposit, 29 holes were completed in the Pit 3 deposit near Goathorn Creek and 13 holes were drilled in the nearby Pit 1-Pit 2 area. In addition 22 reconnaissance holes tested for coal-bearing stratigraphy in previously unexplored areas east of the Pit 3 deposit. An 80 tonne bulk sample was extracted from the Tenas deposit to conduct detailed product testing, to sample host strata for ARD study and to assess environmental impact of mining. Mineable reserves on the property are estimated at 46 million tonnes; 20 million tonnes in Tenas, 16 million tonnes in Pit 3 and satellite deposits, and 10 million tonnes north of the Telkwa River in Pit 7 and 8 deposits. Tenas coal is not faulted and dips gently, forming a broad asymmetric syncline under shallow overburden. It is ideally configured for open pit mining and would be the site of initial development in a 1.0 - 1.5 million tonne per year mine proposed by Manalta. Coal in the Pit 3, 7 and 8 deposits comprises ten seams 150 m stratigraphically above the Tenas seam. The coal is flat

lying to gently dipping but highly segmented by normal and reverse faults that will result in more difficult mining.

Global Mineral and Chemical Ltd. continued exploration of the Louise Lake high-level porphyry system, 35 km west of Smithers. Work by previous operators has outlined 50 million tonnes at 0.3% Cu and 0.3 g/t Au in a 40-70 m thick tabular zone within a feldspar porphyry body intrusive into Skeena Group sedimentary strata (Hanson and Klassen, CIM Special Volume 46). A pyrite-tennantite-chalcocopyrite vein stockwork occurs within a 4 km long zone of intense clay-pyrite alteration near a major fault. A 1995 IP survey indicates the pyritic zone extends further east. Drilling in 1996 encountered wide intervals of fine sulphide including some bornite and molybdenite (S. Tennant, p. comm). More drilling is planned in 1997.

On the Limonite prospect 50 km southwest of Smithers, Telkwa Gold Corp. drilled three holes to test for a high sulfidation epithermal gold deposit deep within a zone of advanced argillic alteration and surficial limonite. The property is underlain by fragmental volcanic rocks of uncertain correlation. Fine grained pyrite was encountered but no significant precious or base metals were intersected (W. Tompson, p. comm).

On the Allin property adjacent to the former Equity Silver mine, Hudson Bay Exploration & Development Co. Ltd. sought the source of silver-copper float in glacial till. The property was explored by Equity Silver Mines in 1994. Hudson Bay consider argillic altered volcanic rocks west of Allin Creek to be correlative with trachyandesite flows of the Tertiary Goosly Lake Group (V. Van Damme, p. comm) rather than the Cretaceous Skeena Group that hosts the ore zone at Equity Silver. A Genie EM survey was conducted and till soil samples were analyzed by an enzyme leach procedure. Conventional analysis delineates weak coincident silver, copper and arsenic anomalies west of Allin Creek.

Black Dog Mining Ltd. explored the Ascot property 30 km east of Smithers late in the 1996 season, by prospecting, gravity, VLF and magnetic surveys. In 1986 Geostar Mining Corporation discovered laminated barite-sphalerite within dolomitic sandstone, siltstone and shale by trenching soil geochemical anomalies identified by Texasgulf Sulphur Company in 1969 (AR 16696 and 16928). Sphalerite is difficult to recognize but a chip sample by Black Dog returned 8% Zn and 10% barite over 4 m. The property is underlain by Hazelton Group argillaceous sedimentary rocks and intermediate to felsic, massive and fragmental volcanic rocks.

On the Burbridge Lake porphyry prospect located south of the idle Dome Mountain gold mine 30 km east of Smithers, D. Groot Logging Ltd. extended an IP survey initiated in 1995. Subsequently ten core holes were drilled but results have not been released. Hera Resources Inc. conducted geological mapping and prospecting on the Loring property 40 km southwest of Smithers. Bulkley quartz-biotite-feldspar porphyry dikes cut Telkwa Formation volcanic rocks. Copper and gold mineralization in calcite-epidote-magnetite skarn will be explored further in 1997. At Blunt Mountain 20 km east of Hazelton, Atna Resources Limited conducted a soil geochemical survey to define better the on-strike projection of polymetallic veins that are peripheral to a Bulkley granodiorite stock.

NORTH COAST AREA

Porcher Island Gold Corp. acquired an option to earn 65% interest in the Porcher Island gold property of Cathedral Gold Corporation 40 km southwest of Prince Rupert. Gold occurs in quartz-pyrite veins which occupy shear and dilatant structures within a four kilometre diameter quartz diorite intrusion. The Surf Point and Edye Pass mines produced 61,570 tonnes with a recovered grade of 10.4 g/t Au from 1934 to 1937. Underground sampling and 91 drill holes between 1979 and 1988 delineated indicated and inferred reserves of 1.36 million tonnes grading 6.85 g/t Au in the AT zone. Drilling by Porcher Island Gold very late in 1996 comprised confirmation holes within the AT resource and exploration holes beyond existing reserves. Results had not been announced at time of writing.

The Yellow Giant property on Banks Island was examined by Energex Minerals, Ltd., with a view to reviving exploration. Gold skarn, vein and disseminated deposits are associated with north-northwest trending belts of deformed and metamorphosed pelitic sedimentary rocks and limestone near the western edge of Coast Range diorite to quartz monzonite plutons. Major drilling programs were conducted on the Tel, Kim, Bob and Discovery zones between 1960 and 1987.

On the Baba property 12 km east of Terrace, Sterlingmarc Mining Ltd. excavated trenches on the Excelsior zone. Shear controlled quartz-pyrite stringers with anomalous copper and gold values occur over a 30 m width in metamorphosed andesite near a Coast Range quartz diorite pluton.

QUEEN CHARLOTTE ISLANDS

Misty Mountain Gold Ltd. continued its reassessment of the Specogna gold deposit, a low

sulphide epithermal hot spring deposit related to a major strike-slip fault. Now named Harmony, the project was formerly known as Cinola. Exploration by Consolidated Cinola Mines Ltd. and City Resources (Canada) Limited from 1975 to 1987 delineated 23.8 million tonnes grading 2.45 g/t Au in a wedge-shaped zone approximately 800 m long, 200 m wide and 50 m deep. Gold occurs in silicified sandstone and conglomerate of the Miocene - Pliocene Skonun formation in the hanging wall of the northeast dipping Specogna fault. The Specogna fault is a footwall splay occurring at a flexure of the regional northwesterly Sandspit fault. Silicification within the deposit is pervasive, locally quartz has replaced bladed calcite, a texture diagnostic of ore fluid boiling. Gold also occurs in a 14 million year old rhyolite intruded along the Specogna fault and, in particular, within a set of banded chalcidonic quartz veins. The quartz veins fill dilatant tear fractures oriented at 030°, oblique to the controlling faults, and average 10 g/t Au versus 1-3 g/t Au in the wallrock (R. Tolbert, p. comm). Previous drill holes were oriented perpendicular to the Specogna fault but in the current re-evaluation holes are orthogonal to the dilational quartz veins. Development options include bulk open pit mining or selective underground mining of the higher grade veins.

STEWART CAMP

Royal Oak Mines Inc. conducted a major surface and underground exploration program at Red Mountain, 16 km east of Stewart. Gold at Red Mountain is related to the Goldslide stock, a multi-phase, subvolcanic hornblende-feldspar diorite that intrudes Late Triassic siliclastic rocks. Disseminated pyrite is widely distributed about the stock but gold, tellurides and associated pyrrhotite and sphalerite occur with a coarse pyrite vein stockwork and breccia in-filling, located preferentially at contacts between apophyses of the stock and the country rocks. The Marc zone decline was extended 302 m to allow underground drilling of the JW zone. Surface drill holes up to 1400 m deep on the projected Marc-AV-JW gold deposit trend found an apparent change in plunge from northwest to north due perhaps to folding or faulting (A. W. Randall, p. comm). Results suggest a new zone 300 m below the elevation of the JW zone. Attempts to drill gold targets at Hartley Gulch 4 km northwest of Red Mountain were frustrated by extremely poor rock conditions and steep topography. A radar survey of the icefield between Red Mountain and Willoughby disclosed a deep vee-shaped bedrock profile. A revised reserve estimate was not available at time of writing.

Camnor Resources Ltd. continued underground and surface drilling of gold zones on the Willoughby

property, 25 km east of Stewart. Gold mineralization is comparable to Red Mountain; controlled by northwest structures, associated with coarse pyrite or pyrrhotite veins in or near hornblende-feldspar subvolcanic diorite, and has a Zn-Pb-As-Sb geochemical signature. Camnor extended the 55 m adit an additional 40 m and tested the continuity of the North zone by underground drilling. Surface drilling was conducted on the Wilby, Lower Icefall and NI (No Ice) zones located 300 m, 600 m and 1500 m respectively on strike to the southeast. A new sulphide lens, Northern Deeps was discovered by drilling on the Wilby zone.

The new Clone gold prospect of Teuton Resources Corp. and Minvita Enterprises Ltd. is situated on a nunatak near the south margin of the Cambria Icefield 18 km southeast of Stewart. Rock trenching and drilling were focused on a 400 m long anastomosing shear zone. Homestake Canada Inc. and Prime Resources Group Inc. provided technical advice on the project. Four 2-4 m wide, northwest striking, vertically dipping shears occur in a 50 m wide interval between Hazelton Group heterolithic andesite breccia to the northeast and an argillaceous horizon within the andesite sequence to the southwest. Cataclastic texture indicates fault movement but the direction is indeterminate. Two gold-bearing mineralogical associations are recognized. Hematite shears are characterized by accessory quartz, chalcopyrite, specularite, magnetite and visible gold, and grade into hematitic andesite. Sulphide shears contain distinctive dark chlorite accompanied by pyrite, arsenopyrite and a cobalt sulpharsenide tentatively identified as glaucodot, with attendant erytherite (cobalt bloom). There may be a zonation from hematite to sulphide mineralogy with increasing depth within individual shears (E. Kruckowski, p. comm). A gold resource estimate is anticipated in 1997.

Levelland Energy & Resources Ltd. located several shear zones, one with significant gold values, on its CY claims on Treble Mountain, 5 km west of Clone. Two kilometers further west on the Marmot property Navarre Resources Corporation drilled 19 holes into a 2 m wide quartz-calcite vein mineralized with pyrite, sphalerite, galena, chalcopyrite and stibnite. Both properties are underlain by intermediate volcanic and sedimentary rocks of the Hazelton Group. On the MM property on Bitter Creek 10 km northeast of Stewart, KRL Resources Corp. prospected for gold in the Cable Creek and Old John zones which are underlain by clastic sedimentary rocks belonging to either the Stuhini or Hazelton Group.

On its Bear Pass property 25 km northeast of Stewart, International Tournigan Corp. explored copper mineralization at the New York showing, following up

on geological mapping and an EM survey conducted by Westmin Resources in 1994. Stratabound chalcopyrite and pyrrhotite with chlorite, quartz, garnet and minor actinolite are associated with iron formation at the contact between andesite and overlying mudstone (D. Gunning and J. Deleen, p. comm). Eleven core holes were completed and a property-wide airborne magnetic survey was conducted. The iron formation horizon is traced several kilometres and implies chemical sedimentation in a sizeable Hazelton basin.

Aquaterre Mineral Development Ltd. continued to drill the Georgia River gold prospect 28 km south of Stewart. Quartz veins occupy broad northwest shears and northerly fault fissures in Unuk Formation volcanic rocks. The Southwest vein belongs to the northerly vein set and contains sparse base metal sulphides and visible gold. Drilling 100 m south of the 150 m strike length of previous drilling, determined that the Southwest vein splays and is cross-cut by a barren quartz vein.

At Big Missouri 30 km north of Stewart, Westmin Resources re-evaluated ore controls on the Martha Ellen gold-silver-zinc zone. Brecciation and silicification accompanied base and precious metal deposition. Drill holes spaced 200 m apart intersected anomalous to sub-ore grade intersections, thereby extending the zone several hundred metres east and proving it dips gently east rather than west as previously thought (D. Pauliuk, p. comm). Like gold-silver ore zones at Premier Gold, the Martha Ellen zone is spatially associated with the contact of a subvolcanic megacrystic K-feldspar dike (Premier porphyry). This new understanding opens up a large area of potential.

The Tide property 40 km north of Stewart is underlain by andesite to dacite of the Unuk River Formation cut by north-northwest trending dikes and a small plug of diorite, possible offshoots of the Summit Lake stock. Gold occurs erratically with quartz and arsenopyrite in northeast ankeritic shears and more consistently in east-west sheeted joints (L. Erdman, p. comm). Hemlo Gold Mines Inc. conducted mapping and sampling but postponed drilling due to adverse weather.

ISKUT CAMP

On the Bonsai property 4 km west of Eskay Creek mine, sericitized rhyolite flow-domes intrude Salmon River formation mudstone. The resultant breccia and associated exhalative pyrite is anomalous in Eskay Creek signature elements (Au, Sb, As and Hg). Homestake Canada Inc. tested the stratigraphic succession at Bonsai for Eskay Creek type mineralization with one core hole from the Salmon

River mudstone to the Mount Dilworth dacite ignimbrite, but assays were low. Canamera Geological Ltd. did geological mapping, soil geochemistry and a UTEM (deep penetration electromagnetic) survey on its Eskay property, adjacent Eskay Creek mine. The ore horizon lies buried beneath complexly folded cover rocks of the Bowser Lake Group.

Discovery of an Eskay-type deposit is also the objective of Kenrich Mining Corp. on the Corey property 10 km south of Eskay Creek mine. The claims are underlain by similar stratigraphy as Eskay Creek, including distinctive rhyolite - black mudstone breccia and wide intervals of low grade gold and silver (e.g. 1.8 g/t Au, 32 g/t Ag over 34.4 m) at the TV zone. In 1996, quartz stockwork mineralization in the TV zone was extended to the north and east by trenching and drilling but no increase in grade was found. A new barite horizon found on the Cumberland zone is reported to average 4100 g/t Ag over 2 metres in a trench but drilling failed to reach the zone. Several new showings were found including HSOV, a massive marcasite occurrence with very similar texture to the Bonsai showing, and an auriferous quartz-pyrite vein at Sheelagh Creek. Kenrich also performed an airborne magnetic and radiometric survey of its large claim holdings.

International Skyline Gold Corporation continued work on the Bronson Slope gold-copper porphyry deposit located less than 500 meters east of the Snip mine. The early Jurassic Red Bluff stock, a 250 m wide dike-like body of orthoclase porphyritic quartz monzonite, extends 2 km along the precipitous northeast facing slope of Bronson Creek. Snip mine's 130 portal is near its northwest end. The core of the stock is completely replaced by a quartz-magnetite stockwork and breccia. Gold and chalcopyrite occur in the quartz-magnetite zone and in adjacent biotite hornfels graywacke. Minor molybdenite occurs peripheral to the gold-copper zone. The mineralized zone is exposed for 500 m in a 100m high, 55° cliff face which presents a significant obstacle to evaluation of the deposit by geological mapping or drilling. An additional 14 holes were completed from above the cliff and a revised geological resource announced of 98 million tonnes at 0.576 g/t Au and 0.20% Cu using a Cdn \$8.00 cut off. Determination of mineable reserves is in progress. International Skyline also conducted metallurgical testwork, geotechnical assessment and various environmental studies related to their plan to develop a 12,000 tonne per day mine.

Three properties near Snip mine were explored by different operators in search of a gold-bearing shear vein similar to the Twin zone at Snip. The Iskut

property 5 km north of Snip mine was explored by Prime Resources Group Inc. in a joint venture with Golden Band Resources Inc. and Asia Minerals Corp. The Gorge zone was reinterpreted and then tested by four drill holes but results were poor. A soil survey and subsequent overburden trenching disclosed pervasive biotite altered siltstone and wacke but no significant gold mineralization (J. Moors, p. comm). Gamah International Limited managed a 14 hole drilling program for Central Asia Gold Corp. on the Iskut claims 4.5 km north of Snip, referred herein as the Iskut River property to distinguish it from the Iskut joint venture described above. Finally, 5 kilometres east of Snip mine, Maple Mark International Inc. explored the Waratah/Jazz property. The Cooper zone was traced by geological mapping, trenching and magnetic and VLF-EM surveys. It pinches out to the northwest and terminates against a fault to the southeast but three new auriferous veins less than one metre wide were discovered (D. Piroshco, p. comm).

The Isk Wollastonite prospect, 13 km west of Snip mine was evaluated by Radcliffe Resources Ltd. Five wollastonite skarn zones (Cliff, Glacier, Bartnick, Brys and Brill) are associated with a four kilometer long nepheline syenite body intrusive into Stikine Assemblage strata. The Brill zone is the largest and measures 300 m by 100 m on surface. Wollastonite content exceeds 80% (B. Jaworski, p. comm).

On the Foremore property at the head of Mess Creek, 50 km northwest of Bob Quinn, Cominco Ltd. drilled a single deep hole in search of the source of massive sulphide boulders at the toe of Mawer glacier. Two conductors were identified under the ice by a UTEM (deep penetrating electromagnetic) survey. The hole was collared in fragmental andesite of the Paleozoic Stikine Assemblage. Two graphitic mudstone units were intersected which are considered to cause the EM response (D. Wagner, p. comm).

Pathfinder Resources Ltd. mapped, prospected and conducted lithochemical, magnetic and VLF-EM surveys on the RDN property 25 km west of Bob Quinn. The Main zone is a quartz-sulphide vein breccia in a northeast fault within felsic volcanic rocks of the Hazelton Group. The zone is traced 130 m and grades 3.1 g/t Au, 0.49% Pb and 1.13% Zn across a true width of 8.3 m (H. Awmack, p. comm). The second target is an Eskay-type massive sulphide deposit in an area where pervasively K-feldspar altered felsic volcanic rocks are overlain by argillite and pillow basalt, analagous stratigraphy to Eskay Creek (H. Awmack, p. comm). At Snoball, 25 km northwest of Bob Quinn, Condor International Resources Ltd. mapped, prospected and trenched gold rich but discontinuous

quartz-arsenopyrite-galena veins in Stuhini Group andesite tuffs.

The Voigtberg property 24 km northwest of Bob Quinn was explored by Hayden Resources Ltd. Three holes were drilled to test an extensive gold, molybdenum, copper and zinc soil anomaly. All holes encountered K-feldspar, sericite and carbonate altered pillow basalt containing 2-10% disseminated pyrite and an average of 0.26 g/t Au. Petrographic and alteration studies were aimed to determine whether mineralization is epithermal, porphyry or volcanogenic.

On the Bam property 55 km northwest of Bob Quinn, Everest Mines and Minerals Ltd explored two gold shear zones. The property is underlain by Permian welded tuff and tuffaceous sedimentary phyllite at the margin of the Jurassic Hickman batholith, a leucocratic granite, and was explored previously by Chevron Canada Resources Limited (AR 15,827) and Radcliffe Resources Ltd. (AR 17,570). A northern, 030° shear appears to be developed in a screen within the granite of altered phyllite containing pale green mica. The nearby southern, 070° shear is entirely within granite. No significant gold was intersected in six core holes.

Geofine Exploration Consultants Ltd. explored the Fox/Delta claims 18 km southeast of Bell II. Oweege dome is a structural high that exposes Hazelton Group strata within the Bowser basin. Five structurally controlled zones with associated IP and soil geochemical anomalies were tested by five diamond drill holes. Wide zones of propylitic altered diorite and pyroclastic volcanic rocks were intersected with a geochemical signature suggestive of porphyry-like gold mineralization (D. Molloy, p. comm).

SUSTUT CAMP

Lucero Resource Corp. explored for gold-copper skarn mineralization on the Gold property 50 km northeast of Bear Lake. Detailed soil geochemical and magnetic surveys were done but no results are available. On the Cisco claims 26 km northeast of Bear Lake, Madrona Mining Limited carried out airborne magnetic and EM surveys and then prospected for the source of disseminated, stringer and banded massive pyrite-pyrrhotite-chalcopyrite boulders in the Porcupine zone. The immediate area is underlain by dacite, locally highly silicified, belonging to the early Jurassic Telkwa formation. Early Jurassic and late Cretaceous intrusions are present in the area and porphyry copper-gold mineralization also occurs on the property in the Day zone 1.5 km southeast of the Porcupine zone. In December Watershed Resources staked claims near the long inactive Sustut Copper deposit.

TOODOGGONE CAMP

Due to a change in MEI Energy & Minerals Division administrative regions the Toodoggone camp, including the JD property, has been assigned to the Prince George region.

STIKINE PORPHYRY CAMP

No exploration was done on the Red Chris copper-gold porphyry prospect 80 km south of Dease Lake. The largest exploration project in northwest British Columbia in 1995 was idle in 1996 because Teck Corporation elected not to proceed with a major drilling program required to complete a final feasibility study. American Bullion Minerals Ltd. released a mineable reserve estimate of 494 million tonnes grading 0.323% Cu and 0.254 g/t Au based on 244 drill holes spaced 50 m apart. American Bullion continued base line environmental studies required to obtain a mine development certificate.

The gold content of the Gnat Pass alkalic porphyry copper-gold prospect 30 km south of Dease Lake was evaluated by Everest Mines and Minerals Ltd. Gnat Pass area is underlain by upper Triassic volcanic and sedimentary rocks which are intruded by granitic rocks of the Hotailuh batholith. Extensive resampling of old drill core stored on the property determined that significant gold generally is not associated with copper mineralization. Magnetic and soil geochemical surveys were done in search of another ore zone.

KUTCHO - TURNAGAIN DISTRICT

Atna Resources Ltd. conducted geological mapping, magnetic, soil and rock geochemical surveys on their Kutcho property 10 km from the Kutcho Creek deposit and 90 km southeast of Dease Lake. The property is underlain by Paleozoic Kutcho formation felsic volcanic strata. The Kutcho Creek deposit contains mineable reserves of 14.3 million tonnes grading 1.76% Cu, 2.54% Zn, 35 g/t Ag and 0.37 g/t Au in the Kutcho lens. There are additional resources in the lower grade Sumac lens and higher grade Esso West lens. On Atna's claims, chalcopyrite-pyrrhotite-pyrite stringer mineralization and a poorly exposed siliceous exhalite is associated with anomalous copper, zinc, lead and silver soil anomalies (G. Bekik, p.comm). On the White Bull property 130 km northeast of Dease Lake, geological mapping by Atna Resources Ltd. sought to delineate stratiform barite and associated base metal sulphides. Host stratigraphy was previously correlated with the Cambro-Ordovician Kechika Group but is now considered to be Devonian Earn Group (P Holbek, p.

comm). A massive pyrite horizon was discovered 10 km to the south.

The Turnagain nickel prospect (Cub claims) 70 km east of Dease Lake was explored by Bren-Mar Resources Ltd. It was explored previously by a series of companies, primarily Falconbridge Nickel Mines Ltd. between 1966 and 1973. Nickel occurs as a magmatic segregation in peridotite within a zoned Alaskan-type ultramafic pluton. The pluton consists of a dunite core, peripheral clinopyroxene-bearing peridotite (wehrlite) and a discontinuous rim of gabbro. Best exposures are on the southeast margin of the complex along the Turnagain River where net textured pyrrhotite (and pentlandite?) is exposed in a series of showings. Work performed consisted of an aerial magnetic survey and five core holes near the Turnagain River. The second hole intersected 0.408% Ni, 0.12% Co and 100 ppm Pt over 22.5 m (E. Livgaard, p. comm). The northwest margin of the complex is unexposed and unexplored.

On the Mount Shea claims 60 km east of Dease Lake, Loumic Resources Ltd. performed a rock and soil geochemical survey and trenching in search of gold in a listwanite zone. The property is underlain by a complex assemblage of serpentinite, schistose graphitic shale, limestone and sericite schist (E. Livgaard, p. comm).

In the Turnagain-Kutcho district, jade is developed within metasomatized antigorite serpentinite of the Cache Creek terrane, in an area bounded by the King Salmon and Kutcho faults (Gabrielse, GSC Open File 2262). Locally, resistant jade blocks are found in overburden or in stream deposits. At Marmot Mountain 40 km east of Dease Lake, Polar Gemstones cut and shipped blocks of nephrite jade from an open cut. On the Provencher/ Letain property 75 km east of Dease Lake, Glenpark Enterprises Ltd tested jade boulders but did not ship any material this season.

CRY LAKE AREA

Approximately 1400 claim units were staked by exploration companies, prospectors and agents in the Cry Lake (104I map area) subsequent to release of a regional stream geochemical survey by the B. C. Geological Survey. The area is prospective for sedimentary and volcanogenic massive sulphide, porphyry copper and gold deposits. Some additional claims were acquired in advance of the release in anticipation of competitors. This includes the Flag and Sail properties of Westmin Resources Limited located 75 km northeast of Dease Lake. Reconnaissance mapping was conducted on the claims which are underlain by the pre-Mississippian Rapid River

tectonite, deformed volcanic and sedimentary rocks tentatively correlated with Yukon-Tanana terrane.

On the Nizi property 80 km northeast of Dease Lake, Madrona Mining Limited drilled six holes to evaluate epithermal precious and base metal mineralization within sericite altered rhyolite or trachyte. Quartz-barite-sphalerite veins occur within a black, K-feldspar phyric, acid tuff. Petrographic study shows the black colour is due to a dense network of fine, carbon-filled fractures and not tourmaline as was suspected. The area has been mapped as Devonian-Mississippian Sylvester Group but the felsic unit may be Permian (J. Nelson, p. comm). The tenor of drill intercepts ranged widely but intercepts of 13.5 g/t Au, 146.8 g/t Ag and 2.85% Zn over 3.0 m and 1.16 g/t Au, 733.4 g/t Ag and 7.8% Zn over 4.5 m demonstrate that significant concentration of metals occurred. More work is planned in 1997.

GATAGA DISTRICT

The Gataga district is underlain by a folded sequence of lower Paleozoic carbonate and clastic sedimentary strata that has been imbricated by a series of easterly directed thrusts. It is a remote and comparatively unexplored segment of the zinc-lead mineral belt that extends the length of the Canadian Cordillera. The B.C. Geological Survey conducted bedrock mapping and regional lake sediment and water geochemistry surveys in an area of subdued topography in the northern Gataga district (Liard Plain). Data will be released in 1997. In August, Tizard Exploration staked 1800 units as the ABCD property extending nearly 100 km south from Lower Post. A high sensitivity airborne magnetic survey was carried out to detect sedimentary exhalative zinc-lead-silver deposits on the ABCD, Border and WL properties. The Border and WL properties are located on the British Columbia-Yukon boundary respectively 10 km east and west of Lower Post.

Cominco Ltd. conducted prospecting, geological mapping and geochemical surveys in search of stratiform zinc-lead massive sulphide (sedex) mineralization on four properties 120-160 km southeast of Lower Post. Stratiform barite in Devonian-Mississippian Earn Group shale was evaluated on the Chief property and a barite "kill zone" found by the B.C. Geological Survey in 1995 was unsuccessfully explored for associated zinc-lead mineralization on the Net property. On the Horn claims a barite-quartz-sphalerite breccia in upper Road River Group was re-examined. A large Zn-Ba soil anomaly underlain by black shales belonging to either the Earn or upper Road

River groups was identified on the Term property (D. Wagner, p.comm).

CASSIAR CAMP

Cyprus Canada Inc. relinquished its option on the Quartzrock (Taurus) bulk tonnage gold prospect in mid-season but International Taurus Resources Inc. continued the planned program of 50 m grid drilling in the principal area of interest, the 88 Hill zone. The target area comprises the underground workings of the Taurus, Plaza and Sable gold mines, plus other showings. Stripping of the 88 Hill zone and prior drilling by Cyprus, shows gold is associated with pyrite within carbonate altered basalt in discontinuous, high angle quartz veins and disseminated in the wallrock. The setting is comparable to Table Mountain mine but at a deeper erosional level. Altered and mineralized basalt is floored by a thrust fault and is underlain by barren argillite. Drilling in 1996 aimed to establish gold grade and continuity by tightening drill hole spacing from the 100 m by 200 m hole pattern drilled in 1995. A combination of core and rotary holes were completed, after a comparative study by Cyprus in 1995 established the reliability of rotary drill data. International Taurus announced an indicated reserve of 13.7 million tonnes at 1.01 g/t Au and an inferred reserve of 25.1 million tonnes at 0.67 g/t Au in the 88-Hill zone. No drilling was done in the Taurus West area 500 m east of 88 Hill because metallurgical testwork by Cyprus showed that gold is refractory. Wings Canyon, a secondary target one kilometre southeast of 88 Hill, was tested by three core holes. No significant gold was intersected and the basal argillite was encountered within about 30 m of surface (B. Spencer, p. comm).

The Keystone property of Nu-Lite Industries Ltd, 50 km south of Cassiar, occurs where shale and serpentinite belonging to the Cache Creek terrane are thrust over the upper Triassic Quesnel volcanic arc. Gold is reported to occur in quartz veins along the footwall of this important suture, the Thibert Creek thrust fault. The fault is incised by Thibert Creek which historically yielded more than 90,000 ounces of placer gold. About one-half of a planned IP survey intended to outline drill targets was completed before severe winter weather forced postponement of the program.

At Storie Silver, 2 km south of Cassiar, Pacific Bay Minerals Ltd. explored for zinc-lead-silver mineralization in lower Cambrian limestone of the Rosella formation. A soil geochemical survey was conducted and one rotary drill hole was completed to test for a manto deposit or skarn near a blind intrusion (F. Moyle, p. comm). On the McDame property 30 km east of Cassiar, KRL Resources Corp. flew a high

sensitivity magnetic survey to explore for a silver-zinc-lead manto deposit (T. Drown, p. comm).

At the former Cassiar mine B.C. Chrysotile Corp. reconstructed a building and installed equipment for a pilot plant to determine feasibility of wet milling the tailings from the former Cassiar processing plant. Jedway Enterprises Ltd. continued to recover nephrite jade from the mine waste dump under contract from B.C. Chrysotile. Jade is associated with chrysotile asbestos and was discarded along with waste rock during open-pit mining at Cassiar.

RANCHERIA CAMP

The Midway zinc-lead-silver manto prospect 95 km southwest of Watson lake was acquired by Imperial Metals Corporation by purchasing controlling interest in Regional Resources Ltd. Imperial Metals estimates mineable reserves of 1,377,000 tonnes at 317 g/t Ag, 5.8% Pb and 8.3% Zn (George Cross Newsletter, Aug 28). A major exploration program is anticipated in 1997. At Ace Mountain 40 km east of Midway, KRL Resources Corp. performed an airborne magnetic survey in hope of detecting a zinc-lead-silver manto deposit (T. Drown, p. comm).

SHESLAY CAMP

The Cop property, located 40 km northwest of Telegraph Creek, is an alkalic porphyry copper-gold target within a diorite stock satellite to the Triassic Kaketsa pluton. The prospect has an extensive history of geophysical surveys and trenching but little drilling. A trench excavated in 1977 assayed 0.41% Cu and about 0.5 g/t Au over a 179 m length. In 1996 Erin Ventures performed a VLF-EM survey but were unable to complete any of their planned drill holes due to inadequate equipment.

TATSAMENIE CAMP

At the Golden Bear mine 80 km northwest of Telegraph Creek, North American Metals Corp. installed the liner on a previously prepared surface for the 500,000 tonne capacity Fleece Bowl cyanide heap leach pad. In December regulatory approval was given to construct the Ursa open pit and a second leach pad with a capacity of 1.5 million tonnes. Mineable reserves comprise 511,000 tonnes at 7.0 g/t Au in the Ursa deposit (strip ratio of 6.6 to 1) and 824,000 tonnes at 3.3 g/t Au in the Kodiak A deposit (strip ratio of 1 to 1). The Kodiak B deposit adjacent to the Fleece Bowl leach pad contains a geological resource of 278,000 tonnes containing 8.6 g/t Au. Eleven infill holes were drilled to upgrade the Kodiak B resource into an underground

mine plan but a mineable reserve estimate was not available at time of writing. A Mines Act permit is anticipated in June, 1997. The East Low Grade stockpile (Bear Main waste dump) was evaluated by 61 rotary drill holes. Determination of a mining plan and mineable reserves are in progress. Exploration of the Ridge zone geochemical anomaly southwest of Kodiak located a 15 m wide breccia zone with low gold content across the head of Fleece cirque. Exploration elsewhere on the property resulted in discovery of gold in the South, C & C and LCF (Limestone Creek fault) zones. The South zone underlies a 1.2 km long gold geochemical anomaly. A structure was detected by HLEM survey that might be a splay off the Bear Main zone although it has a different trend. New areas of high exploration potential are indicated by discovery of the LCF zone 2-3 km west of previously known gold zones. A wildcat hole in an overburden covered area was targeted on a diffuse gold-antimony-arsenic-mercury geochemical anomaly. It intersected 7.9 g/t Au over 4.6 m but follow-up drilling was inconclusive. The C & C zone lies a further 100-200 m west of the Limestone Creek fault in calcareous wacke.

Gold mineralization at Golden Bear is very finely disseminated in shear zones and in structurally controlled carbonate replacement zones related to the Ophir break, a steep braided fault zone that juxtaposes Permian limestone against Stuhini Group mafic volcanic rocks. The Bear Main and Grizzly gold deposits are located in major faults. Other deposits, such as Kodiak A and Ursa are located on subtle footwall splays up to hundreds of metres from a major fault. Ore zone alteration consists of pervasive replacement by silica or dolomite and veins are completely absent. Mineralization has a distinctive epithermal geochemical signature: gold, mercury, arsenic, antimony and tellurium, with a low silver to gold ratio. Gold in hypogene deposits (Bear Main and Grizzly) is refractory whereas gold in supergene deposits (Ursa, Kodiak A and B) is highly amenable to cyanide heap leach recovery. These characteristics are entirely consistent with Carlin-type gold deposits. Differences between gold deposits in the two districts (aside from size) can be attributed to steep faults and tightly folded stratigraphy at Golden Bear in contrast to the importance of low angle faults and flat lying stratigraphy in the Carlin district.

The Heart Peaks high level, low sulphidation epithermal system 85 km northwest of Telegraph Creek was reappraised by Canamera Geological Ltd. Strong gossan zones are associated with trachyte eruptive centres, phreatic breccias and silicification within the Pliocene Heart Peaks Formation. Geological mapping, geochemistry and IP were used to identify drill targets

with the hypothesis that lower elevations in the system might yield higher gold values than found by Kerr-Addison Mines Limited in 1984. Kerr-Addison's work indicated the system has a high silver to gold ratio. New zones of pyrophyllite alteration were found but two drill holes, 265 m and 520 m deep, did not locate significant mineralization.

On the Ant and Bing properties 80 km northwest of Telegraph Creek, Canamera Geological Ltd explored porphyry copper systems for gold mineralization. On the Bing claims, a molybdenite stockwork associated with chlorite altered diorite was drilled by Newmont Mining Corporation of Canada Ltd. in 1966. Although low gold values were determined from the old core, several drill targets were identified by IP and gold soil geochemistry. A prospective zone of silicified limestone with hematite and jasper, and anomalous in arsenic, antimony and lead was found north of the Bing porphyry. Appearance of the zone and geochemical signature are reminiscent of mineralization at Golden Bear 15 km to the southwest. On the Ant property mapping led to a re-interpretation of the deposit and extended an actinolite-epidote-chalcopyrite skarn zone to the southeast.

TULSEQUAH CAMP

In late November Redfern Resources Ltd. filed its Tulsequah Chief project report with government regulatory agencies seeking approval to construct a 2,466 tonne per day underground mine 100 km south of Atlin. The project is based on a mineable reserve of 7.9 million tonnes containing 1.27% Cu, 1.18% Pb, 6.35% Zn, 100.9 g/t Ag and 2.42 g/t Au in a volcanogenic massive sulphide deposit. Waste pyrite is proposed to be recovered in the mill and returned underground as backfill to mitigate acid rock drainage. If built, the mine would be accessed via 160 km of new and upgraded road from Atlin so that concentrate products could be trucked 517 km to an existing deep water port in Skagway Alaska.

Golden Angus Mines, operating subsidiary of Canarc Resource Corp., began a program of underground rehabilitation and detailed diamond drilling to define mineable reserves at the former Polaris Taku gold mine, 6 km south of Tulsequah Chief. Gold is associated with disseminated arsenopyrite in

conjugate, shear-controlled quartz-ankerite vein stockworks developed within Devonian mafic volcanic rocks. The shear zone is a splay of the 220 km long Llewellyn fault. Prior drilling outlined a geological resource of 2,605,000 tonnes grading 14.5 g/t Au, at a cut off grade of 6.9 g/t Au. A total of 24 holes were completed on the AJ level and drilling is scheduled to resume early in 1997. The caved Polaris level portal, about 35 m below the AJ level, was excavated in preparation for continued rehabilitation and drilling. Deeper mine levels are flooded to 24 m below the Polaris level and dewatering is scheduled early in 1997 (D. Darby, p. comm).

ATLIN CAMP

On the Racine property 54 km west of Atlin, Westmin Resources Limited explored a gold-cobalt skarn with 6 core holes. Pre-Permian schist and gneiss of the Boundary Ranges metamorphic complex host a 10-30 m wide, semi-stratabound magnetite-diopside-garnet-amphibole skarn intruded by Cretaceous to Tertiary granitic bodies. The skarn contains cobaltite, arsenopyrite, pyrrhotite, chalcopyrite, bismuthinite and gold. Drilling encountered poor mineralization, attributed to post-skarn faulting and intrusions (S. Rowins, p. comm). The property is 5 km west of the Llewellyn fault, a major structure separating Stikine terrane to the east from intrusive and metamorphic rocks of the Coast Crystalline Complex on the west. Westmin Resources Limited also explored the Bennett property 75 km northwest of Atlin. Some fifteen gold skarn and vein showings occur within 1-2 km of the Llewellyn fault. Magnetic, VLF and IP surveys and geological mapping were completed over an amphibole skarn and revealed strong structural control to pyrrhotite-pyrite-chalcopyrite-gold mineralization. Rotary drilling through an overlying boulder and talus field encountered difficulties and the program was curtailed.

Placer mining continues to be the economic mainstay of Atlin. The most significant mining operations in 1996 were those of Newstar Placer Inc., Daniel Johnson, Kim Ferguson and Peter Burjoski all on Spruce Creek, Ruby Gold Ltd. on Ruby Creek, Sisters Resources on Wright Creek, Ed Kolody on Otter Creek, Arrow Mining on McKee and Wilson Creeks, and West Coast Paving on McKee and Eldorado Creeks.

1996 EXPLORATION AND DEVELOPMENT HIGHLIGHTS FOR THE NORTHEAST-CENTRAL REGION OF BRITISH COLUMBIA

**By Bob Lane, P.Geo.
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INTRODUCTION

The level of exploration activity during 1996 in the Northeast-Central Region increased for the third consecutive year. Decisions to proceed with mining of the Kemess South and Mount Polley gold-copper deposits spurred exploration in both areas, and there was a general increase in exploration for porphyry deposits. There was also increased interest in bulk tonnage gold targets, as well as smaller, bonanza-style gold vein and gold-enriched skarn deposits.

The estimate for exploration expenditures in the region rose 19% to \$16.3 million (Figure 1) and the amount of exploration drilling increased by 27% to 64 640 metres (Figure 2). However, Notice of Work submittals for the year decreased by 13%, from 789 to 686. There were 58 fewer placer notices and 37 fewer

mineral notices in 1996.

Some of the years highlights include:

- Development of the Mount Polley open pit copper-gold mine, by Mount Polley Operating Company, began in the spring; construction of most major mine components is on, or ahead, of schedule and production is expected to commence in June, 1997.
- The Kemess South gold-copper project, owned by Royal Oak Mines Inc., received its provincial Project Approval Certificate on April 29, 1996. Site construction commenced in July and rapidly progressed throughout the year; mine startup is scheduled for April, 1998.
- Exploration by Kinross Gold Corporation in the vicinity of the West zone, at its QR gold mine, resulted in the addition of approximately 8 months of millfeed to the reserve base.
- Exploration drilling of the Akie Zn-Pb-Ag sedex deposit, in the Gataga region, by Inmet Mining Corporation continued with mixed results; Ecstall Mining, Inmets JV partner, will be the operator in 1997 and will continue to test the Cardiac Creek horizon at depth.
- Spokane Resources conducted two effective drilling campaigns on the promising Mac Mo-Cu porphyry prospect, northeast of Babine Lake.
- Rehabilitation of underground workings at the old Cariboo Gold Quartz mine, by International Wayside Gold Mines Ltd., provided access for percussion and drilling aimed at proving up open pitable, bulk tonnage gold reserves.
- AGC Americas Gold Corporation conducted a major diamond drilling program on the JD epithermal gold deposit, in the Toodoggone, and acquired additional ground in the region in advance of an expanded exploration program.
- Pine Valley Coal Ltd. conducted 2 phases of rotary drilling on the Willow Creek coal property to increase established reserves.

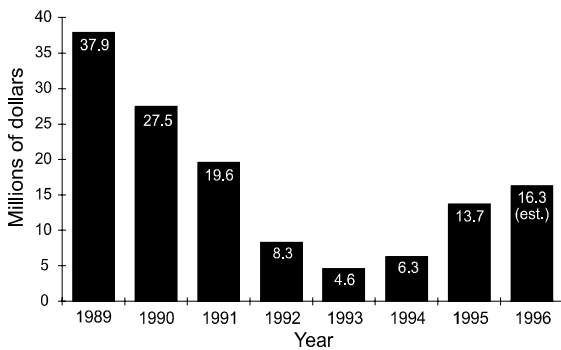


Figure 1. Annual exploration expenditures, Northeast-Central Region

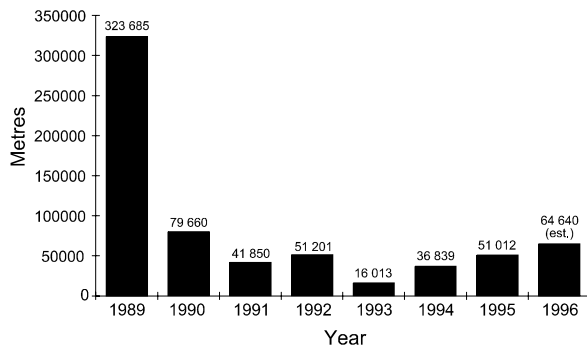


Figure 2. Annual exploration drilling Northeast-Central Region

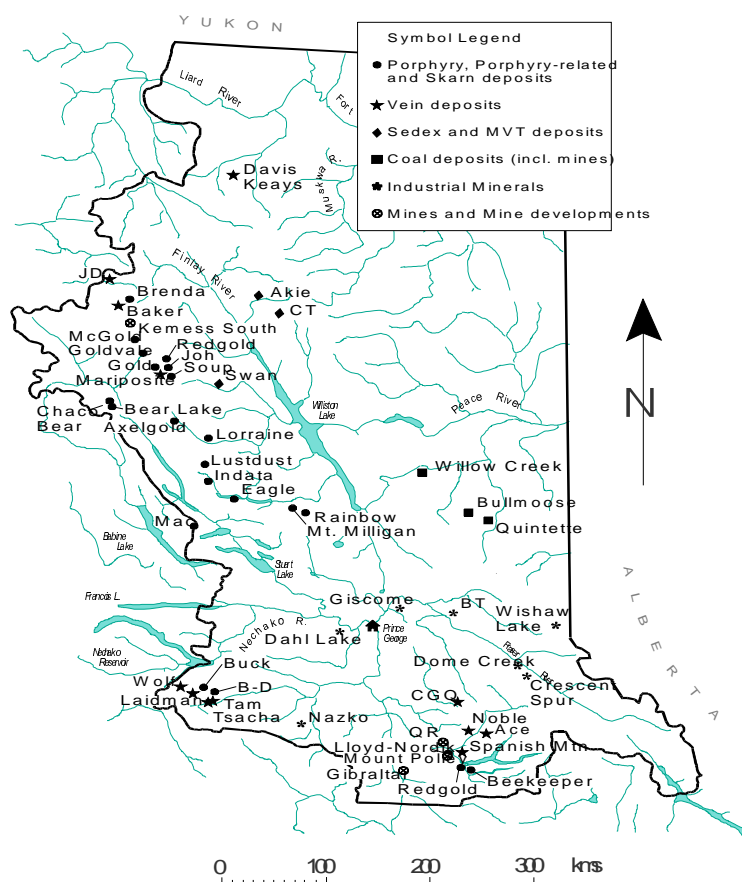


Figure 4. 1996 Exploration Highlight Projects Northeast-Central Region

- Placer Dome Inc. continued to conduct ‘spade work’ on its Mt. Milligan copper-gold property in an attempt to get the project off the shelf.
- Teck Exploration Ltd. returned to the Tsacha property to further explore the extent of the Tommy vein system.
- Eleven Prospectors Assistance Program grants, ranging from \$6,400 to \$8,100, and totaling \$78 000, were awarded for projects in the region.

Exploration focused primarily on gold-copper and molybdenum-copper porphyry systems, epithermal gold veins, gold-enriched skarns, and zinc-lead-silver sedex targets (Figure 3). There was a high level of exploration activity in the Cariboo (southern Quesnel trough) and Omineca (northern Quesnel trough) regions for copper-gold porphyry deposits. Exploration for bulk tonnage and bonanza-style gold deposits continued in the Cariboo (*i.e.* Cariboo Gold Quartz and Spanish Mountain projects) and Toadoggone (*i.e.* JD prospect) regions.

This report is a compilation of information collected from property visits by the Regional Geologist and other Prince George Regional Operations staff, as well from numerous mine and exploration geologists

working throughout the region, news releases and company annual reports. The projects highlighted in this paper are shown in Figure 4. Major exploration projects in 1996 are listed in Table 1 and many of these are briefly outlined below.

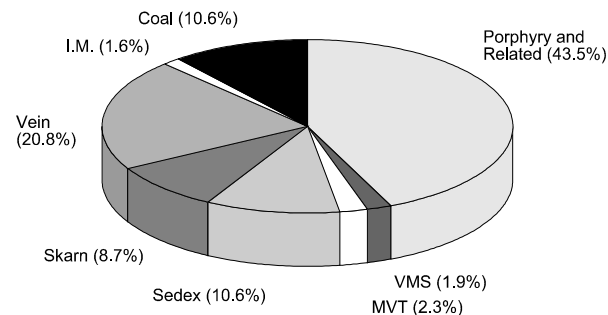


Figure 3. Exploration targets expressed as a percentage of the 16.3 million spent during 1996 in the Northeast-Central Region

METAL MINES

In 1996, there were 3 metal mines operating in the region.

The **QR** gold mine (Photo 1), owned and operated by Kinross Gold Corporation, opened in June,

TABLE 1. MAJOR EXPLORATION PROJECTS, NORTHEAST-CENTRAL REGION

PROPERTY (Operator)	MINFILE NUMBER	MINING DIVISION	NTS	COMMODITY	DEPOSIT TYPE	WORK DONE
ACE (Barker Minerals Ltd.)		Cariboo	93A/14	Au	"VMS, vein"	"7 tr, 400 m; 36 test pits; geochem; IP"
AKIE (Inment Mining Corp.)	"094F 007, 023"	Omineca	94F/7	"Zn, Pb, Ag"	sedex	"11 ddh, 4983 m; geochem"
AXELGOLD (Cyprus Canada Inc.)	093N 196	Omineca	93N/13W	Au	vein	"3 tr, 360 m; geochem"
BEEKEEPER (Eastfield Resources Ltd.)	093A 155	Cariboo	93A/6	"Cu, Au"	porphyry	"11 ddh, 1500 m"
BLACKWATER- DAVIDSON (Kennecott Canada Exploration Inc.)	093F 037	Omineca	93F/2	"Au, Ag, Zn, Cu, Mo"	transitional	geochem; geophys
BUCK (Blackstone Resources Inc.)	093F 050	Omineca	93F/3E	"Cu, Pb, Zn, Ag, Au"	transitional	"6 ddh, 1176 m"
BV (Big Valley Resources Inc.)		Cariboo	93A/12	"Cu, Au"	porphyry	"geophys, geochem."
CARIBOO GOLD QUARTZ (International Wayside Gold Mines Ltd.)	093A 006	Cariboo	93H/4E	Au	vein	"760 m u/g rehab; 54 u/g pdh, 1379 m; 13 u/g & surf. ddh, 582m "
CHACO BEAR (Imperial Metals Corp.)	094D 003	Omineca	94D/2W	"Cu, Au"	transitional	"5 ddh, 1000 m; vlf-em, IP"
CT (Cominco Exploration Ltd.)	094F 010	Omineca	94F/1W	Zn	sedex	"3 ddh, 875 m"
EAGLE (Birch Mountain Resources Ltd.)	"092N 092,139"	Omineca	93N2	Au	porphyry	"6 ddh, 1850 m; max-min; mag"
GIBRALTAR (Westmin Resources Ltd.)	093B 012	Cariboo	"93B/9E, 9W & 8W"	"Cu, Mo"	porphyry	"16 ddh, 2427 m"
GOLD (ASTIKA PEAK) (Lucero Resource Corp.)	094D 098	Omineca	94D/9W	"Au, Cu"	porphyry	geochem; mag; vlf-em
GOLDVALE (Consolidated North Coast Industries Ltd.)	"094D 004 037,149,150"	Omineca	"94D/9W, 10E"	"Au, Cu"	porphyry	"6 ddh, 900 m; IP"
INDATA (Eastfield Resources Ltd.)	093N 192	Omineca	93N/6W	Au	vein	"6 ddh, 514 m"
JD (AGC Americas Gold Corp.)	094E 171	Omineca	94E/6E	"Au,"	vein	"59 ddh, 6100 m; mag;IP, vlf-em;"
JOH (International Conquest Exploration Ltd.)	094D 144	Omineca	94D/9E	"Au, Cu"	skarn / replacement	"5 ddh, 400 m"
KEMESS SOUTH (Kemess Mines Inc.)	094E 094	Omineca	94E/2	"Au, Cu"	porphyry	"22 ddh, 3319 m (geotech)"
LAIMAN (Phelps Dodge Corp. of Canada Ltd.)	093F 067	Omineca	93F/3W	Au	vein	"tr, 600 m; geochem"

British Columbia

PROPERTY (Operator)	MINFILE NUMBER	MINING DIVISION	NTS	COMMODITY	DEPOSIT TYPE	WORK DONE
LLOYD-NORDIK (Big Valley Resources Inc.)	093A 160	Cariboo	93A/12E	"Au, Cu"	porphyry	"46 ddh, 7400 m"
LORRAINE (Lysander Gold Corp.)	093N 002	Omineca	94N/14W	"Au, Cu"	porphyry	"10 ddh, 1350 m; geochem"
LUSTDUST (Teck Exploration Ltd.)	093N 009	Omineca	93N/11E	"Au, Ag, Zn, Pb"	manto / skarn	tr; geochem; mag
MAC (Spokane Resources Ltd.)	093K 097	Omineca	93K/13W	"Mo, Cu"	porphyry	"28 ddh, 6247 m; IP, mag"
MCGOLD (Consolidated North Coast Industries Ltd.)	"094D 128,129"	Omineca	94O/15E	"Au, Cu"	porphyry	geochem; IP
MOUNT POLLEY (Mount Polley Operating Company)	093A 008	Cariboo	93A/12E	"Au, Cu"	porphyry	"7 ddh, 992 m"
MT. MILLIGAN (Placer Dome Inc.)	093N 191	Omineca	93N/1E	"Au, Cu"	porphyry	geotech drilling
NOBLE (Noble Metals Group)	093A 023	Cariboo	93A/13E	Au	vein	"4 ddh, 850 m;"
QR (Kinross Gold Corp.)	093A 121	Cariboo	93A/12W	Au	skarn	"52 ddh, 4546 m "
QUINTETTE (Teck Corp.)	093P 019	Liard	"93P/3E, 93I/14E"	Coal	sedimentary	geotech invest. for proposed Babcock development
RAINBOW (Abitibi Mining Corp.)		Omineca	93O/4W	"Cu, Au"	porphyry	"4 ddh, 567 m; IP, geochem"
REDGOLD - OMINECA (Consolidated North Coast Industries Ltd.)	"094D 162, 163"	Omineca	93A/6W	"Au, Cu"	porphyry	"1 ddh, 275 m; IP, geochem "
REDGOLD - CARIBOO (Imperial Metals Corp.)	093A 058	Cariboo	93A/6W	"Au, Cu"	"skarn, porphyry"	"4 ddh, 411 m; 5 tr, 100 m; IP"
SOUP (Vital Pacific Resource Corp.)	094D 025	Omineca	94D/8E	"Au, Cu"	"skarn, replacement"	"9 ddh, 750 m"
SPANISH MTN. (Cyprus Canada Inc.)	093A 043	Cariboo	93A/11E	Au	vein	"8 tr, 2666 m"
SWAN (Stratabound Minerals Corp.)	"094C 073, 074"	Omineca	"94C/5E, 6W"	"Zn, Pb, Ag"	MVT	"6 ddh, 783 m"
TAM/TAKEN (Phelps Dodge Corp. of Canada Ltd.)	093F 068	Omineca	"93F/2W, 3E"	Au	vein	"9 ddh, 1263 m"
TSACHA (Teck Exploration Ltd.)	093F 041	Omineca	"93F/9E, 2W"	"Au, Ag"	vein	"23 ddh, 3366 m; 14 tr, 500 m; geochem"
WILLOW CREEK (Pine Valley Coal Ltd.)	093O 008	Liard	93O/9	Coal	sedimentary	"244 ddh, 10000 m; 4 tr, 2500 m"
WISHAW (Ava Resources Inc.)	093H 131	Liard / Cariboo	"93H/16W, 93I/1W"	Quartzite	metamorphic	predevelopment of quarry site
WOLF (Lucero Resource Corp.)	093F 045	Omineca	93F/3W	"Au, Ag"	vein	"9 ddh , 2740 m"



Photo 1. Looking northwesterly over the QR gold mine. The Main zone open pit is in the foreground. The carbon-in pulp cyanide leach plant and ore stockpile (centre) are flanked to the left by the Midwest zone portal, above which is situated the mine office (white building). Water storage pond and tailings dam are to the right of the mill. The West zone is off the photograph to the left or west (photograph taken by Ed Beswick, August 13, 1996).

1995 and produced 21 215 ounces (695 850 grams) of gold during the first six months of operation. Gold production in 1996 totaled 43 421 ounces (1 356 993 grams) of gold and 16 023 ounces of silver from 382 472 tonnes of ore milled. Operating costs were US\$267 per ounce of gold produced. As of January 1, 1997, the remaining proven and probable ore reserves (non-diluted) for the Main, Midwest and West zones totaled 1 304 635 tonnes grading 4.70 grams per tonne Au.

The mill operated smoothly at 1200 tonnes per day (400 tonnes per day over the designed capacity) for the bulk of the year, making up for a very slow start to the year when severe winter conditions slowed production.

Mining resumed in mid-March, 1996, following a planned shutdown of all open pit activity for the winter. Ore extracted from the Main zone pit, and from a small open pit developed on the northwest end of the West zone, fed the mill for the remainder of the year until mining ceased again in mid-December. More than 800 metres of underground development was completed on the Midwest zone with mining on the 985 and 1005 levels scheduled to commence in late January-early February, 1997. Reserves in the Main zone will be exhausted by August, 1997. Approximately 170 000 tonnes will be mined from an open pit to be developed on the southeast end of the West zone.

The 1996 exploration program included 52 diamond drill holes totaling over 4500 metres. Drilling of the Hillside anomaly, southeast of the Main zone pit, and soil anomalies northwest of the West zone, failed to identify ore grade mineralization. However, surface drilling on the margins of the West zone outlined an additional 8 months of mill feed. Several other targets were also drilled including the North zone (below Walleys fault), and shallow mineralization on the Midwest zone. Exploration plans for 1997 include an expanded diamond drill program to test the basalt-siltstone contact east of the Main, North and West zones and a mapping and geochemical sampling program south of the Quesnel River.

Late in 1996, Westmin Resources Limited acquired Gibraltar Mines Limited, and the **Gibraltar** mine, through its wholly-owned subsidiary, WRL Acquisition Corp.

In 1996 Gibraltar produced 31 691 tonnes of copper (2 555 tonnes of which was cathode copper) and 182.3 tonnes of molybdenum from 13.2 million tonnes of ore milled at a rate of approximately 38 000 tonnes per day. Proven and probable reserves for the Gibraltar East, Granite Lake and Pollyanna deposits, as of December 31, 1996, totaled 142.5 million tonnes grading 0.303% Cu and 0.009% Mo, sufficient to sustain operations for about 11 years. The leachable ore

reserve, for the Connector zone and Pollyanna stage IV pit combined, is 3.04 million tonnes at an acid soluble grade of 0.197% Cu. The Gibraltar North and Sawmill mineralized zones are not part of the mineable reserves at Gibraltar.

In 1996 mining took place from the Gibraltar East stage 3 pit. Its reserves will be exhausted by early 1999. Stripping of the Pollyanna stage 4 pit is expected to get underway in mid-1997. Development of the stage 3 and 4 Granite Lake pit will follow.

Exploration drilling in the Pollyanna/GM area and the Sawmill skarn zone (located south of the dormant Granite Lake pit), resulted in the addition of 25 million tonnes to the Gibraltar mineral resource base. A soil geochemical survey was conducted on the ZE claims, north of the tailings dam.

In May, 1996, Sable Resources Ltd. was issued an amended permit to mine, by open pit methods, ore remaining at its Multinational B gold-copper deposit, part of the old **Baker** mine property in the Toodoggone. Sable Resources produced 52 700 grams of gold, 498 860 grams of silver and 8.6 tonnes of copper, from the milling of 2338 tonnes of ore from the Multinational B orebody. In 1997, the company plans to mine additional tonnage from this small open pit development, as well as reprocess approximately 2300 tonnes of tailings. A modest exploration program is also planned.

COAL MINES

Coal is the single most valuable mineral commodity mined in the Northeast-Central Region. The Quintette and Bullmoose mines, located near Tumbler Ridge and developed in the early 1980s, are the regions two operating coal mines. Both operations produce metallurgical grade "sub-bituminous" coal that is exported to Japan.

The **Bullmoose** mine, 61% owned by Teck Corporation, produced 1.92 million tonnes of clean metallurgical coal during 1996, a slight increase over the 1995 total of 1.86 million tonnes. Mining takes place from the South Fork pit, which has a mineable reserve of 10.9 million tonnes (sufficient until 2003). A 30-hole, 3000-metre drill program, to test for coal quality, was conducted within the active pit. The coal resource in the nearby West Fork deposit is an estimated 14.3 million tonnes and may be developed in the future.

The **Quintette** coal mine, operated by Teck, produced 3.43 million tonnes of clean metallurgical coal in 1996, down from the 1995 total of 3.69 million tonnes. Clean coal reserves, of approximately 9 million tonnes, are contained in Mesa, Wolverine and Shikano

pits. Shikano will be in operation for another year before its reserves are exhausted. Additional reserves are contained in the Mesa Extension and Babcock deposits. The Babcock mine plan was revised in 1996 and calls for far less land disturbance than originally proposed (1982) in order to extract coal reserves from the Little Windy and Big Windy pits. Little Windy Phase 1 development commenced in 1996 and is scheduled for completion in the fall of 1997. The current mineable reserves for the Babcock deposit are 11.5 million tonnes at a strip ratio of 8.8:1.

INDUSTRIAL MINERALS OPERATIONS

Three small quarries, Giscome, Dahl Lake, and Nazko, produced material used principally for landscaping. The **Giscome** quarry, owned and operated by Kode - Jerrat Quarries Ltd., also produced a small tonnage of chemical grade limestone on a demand basis. This material is purchased by local pulp and paper mills, but the marketplace is changing. Several local mills have re-engineered their plants and now use (burnt) calcined lime, in place of standard crushed chemical grade limestone.

The **Dahl Lake** limestone quarry, 50 km southwest of Prince George, is operated intermittently by Northrock Industries Ltd.

At the **Nazko** lava rock quarry, Canada Pumice Corporation produced 11 000 cubic yards of crushed vesicular lava from a cinder cone located 75 kilometres west of Quesnel.

MINE DEVELOPMENTS

By early 1998 there will be two new bulk tonnage, open pit metal mines operating in the region. They are the Mount Polley copper-gold development, 56 kilometres northeast of Williams Lake and the Kemess South gold-copper operation, approximately 300 kilometres northwest of Mackenzie. After comprehensive environmental and public review, these projects received the necessary government approvals to begin mine construction.

Construction of the **Mount Polley** gold-copper mine (Photo 2) is well ahead of schedule and mine start-up, originally set for October, 1997, has been moved up 5 months to June 1. Mount Polley is owned jointly by Imperial Metals Corporation (55%) and Sumitomo Corporation of Japan (45%). The mine is being developed by the Mount Polley Operating Company. Sumitomo will be the concentrate marketing agent for the partnership.



Photo 2. Looking southerly over the Mount Polley mine development with Bootjack Lake in the upper right. Rows of blast hole cuttings identify the starter pit (centre) and construction of the crusher and concentrator buildings are beginning to take shape in the upper left. Areas cleared in the middle and foreground will be part of the open pit (photograph taken by EdBeswick, August 13, 1996).

The Mount Polley deposit consists of 3 zones, Cariboo, Bell and Springer, with combined mineable ore reserves of 82.3 million tonnes grading 0.3% Cu and 0.417 g/t Au. Once mined, the zones will form a single interconnected open pit. The deposit is contained within the Early Jurassic Polley stock, composed mainly of diorite and intrusion breccias, that intrudes Triassic Nicola volcanics. More than 30 years have passed since the first exploration program on the property. Extensive diamond drilling by several different operators evaluated the claims during the 1960s, 1970s and 1980s. A mineable reserve, calculated in 1990, was revised in 1995 to its present total.

The 18 000 tonne per day operation will produce 100 000 ounces of gold (3.1 million grams) and 26 million pounds of copper (12 700 tonnes) annually over the first 4 years of the mines' minimum 12 year life. The operation will create 170 new, full-time jobs.

Development of this \$123.5 million project is ahead of schedule and on budget. The concentrator and crusher buildings have been erected and interior construction continued throughout the winter. Approximately 750 000 tonnes of ore and waste were mined from the starter pit, located between the Cariboo and Bell pits. The crushing plant is expected to start up in the spring and process waste for use as road bed material. Mined and stockpiled ore from the first two benches in the starter pit will feed the mill at startup.

Power to the site is provided by a recently completed 69 kV electric transmission line extending from McLeese Lake.

A 7-hole, 990-metre exploration drill program tested several zones on the property, including the Road zone, just north of the pit area.

The **Kemess South** mine development (Photo 3), owned and operated by Kemess Mines Inc., a wholly owned subsidiary of Royal Oak Mines Inc., is scheduled to open in the spring of 1998. The 45 000 tonne per day milling operation will produce approximately 250 000 ounces of gold and 60 million pounds of copper each year over its minimum 16 year life. The mineable ore reserve is 200 million tonnes grading 0.63 g/t Au and 0.22% Cu which contains 4.1 million ounces of gold and 900 million pounds of copper. The likelihood of adding to the existing mineable reserve is considered to be excellent. Several other gold-copper deposits, such as Kemess North, which contains an estimated 1.9 million ounces of gold and over 600 million pounds of copper, occur in the immediate area of the mine site on mineral claims owned by Royal Oak.

Discovered in 1983, extensive diamond drilling up until 1991 outlined the present Kemess South deposit. The deposit is not exposed at surface. This blind discovery was made by drill testing geochemical and geophysical anomalies. Prospectors were originally



Photo 3. Looking north toward the Kemess South mine development project, July 30, 1996. The cleared area in the centre is now an operational airstrip and the cleared areas in the background, from left to right, now house the completed permanent camp, and mine and mill buildings which are under construction.

drawn to the region because of the prominent, rust coloured ridges that occur immediately to the north, and in part comprise the Kemess North deposit.

The Kemess South deposit is hosted by the Early Jurassic Maple Leaf intrusion, a gently inclined sheet of quartz monzodiorite. The ore body measures 1700 metres long by 650 metres wide and ranges from 100 metres to over 290 metres thick. A blanket of copper-enriched supergene mineralization, containing native copper, overlies hypogene ore and comprises 20% of the deposit.

The remote location of the deposit prompted the company to construct a 2000-metre by 50-metre airstrip. Housing units brought down from the closed Lawyers mine, are now fully commissioned. Construction of the service complex, mill buildings and a tailings dam are well underway. Clearing the right-of-way for a 380 kilometre, 230 kV electric transmission line, to the BC Hydro Kennedy Substation near Mackenzie, began in late February, 1997. A 59 km access-controlled private haulage road, connecting the project to the BC Rail line near Sloane, has been proposed and if constructed would be used to transport copper-gold concentrate from the mine to the railhead.

The projected capital cost of the development is \$390 million. The mine will employ approximately

310 workers. An estimated 700 workers will be on site during peak construction in mid-1997.

Placer Dome Inc. continues to re-evaluate the economics of the **Mt. Milligan** bulk tonnage Cu-Au porphyry project in the Omineca. In 1996, site work included test pitting, geotechnical drilling and a fish study as well as public relations meetings. The company is reviewing all options and is developing a revised pre-feasibility report that should be complete in 1997.

EXPLORATION HIGHLIGHTS

GATAGA/KECHIKA TROUGH

Eleven holes, totaling 4983 metres, were drilled on the **Akie** (Cardiac Creek horizon) Zn-Pb-Ag sedex deposit this summer by Inmet Mining Corporation. Two attempts to drill deep holes in more competent rocks on the footwall side of the zone failed to reach their target. However, hole A-95-19, which had been stopped 400 metres above its target depth, was successfully re-entered, but encountered 8 metres of semi-massive sulphide mineralization of sub-ore grade. The zone was also drill tested along strike on 1 km stepouts from the known extent of the Cardiac Creek horizon with limited success. Although these

intersections confirm the continuity of the mineralized zone, they lack the width and grade necessary to be considered ore grade intersections.

The stratabound zone occurs in laminated black shales toward the base of the Late Devonian Gunsteel formation (Earn Group). It is defined by 12 drill hole intersections over a strike length of 1400 metres and to a depth of 600 metres. The true thickness of the zone ranges from 10 to 30 metres and has an average grade of about 10% combined Zn-Pb.

Nodular barite, with local zones of laminated pyrite, is common throughout the hanging wall and a broad, carbonate stockwork zone occurs above laminated pyrite that forms the immediate hanging wall to the finely laminated sphalerite-pyrite-galena ore horizon. In several holes, a low angle fault (sub-parallel to bedding) has been intersected in place of the ore horizon and it may or may not contain mineralization. Footwall breccia, with rounded clasts of Gunsteel shale, Road River siltstone, pyrite and limestone, is typically encountered beneath the ore horizon, before intersecting monotonous grey siltstone of the Road River Group.

Ecstall Mining Corporation has become operator of the "Gatagta Joint Venture", following discussions with partner Inmet Mining, operator of the project for the past few years, and is committed to expend in excess of \$1.15 million on the property in 1997.

Cominco Exploration Ltd. was the only other company active in the region. They completed a modest diamond drill program on the CT claims, targeting stratabound mineralization, but no assays have been released. The company also staked a number of claims along the trend to the northwest which will be investigated during the upcoming field season.

CARIBOO

The most significant exploration targets in the Cariboo were gold-enriched copper porphyry, and porphyry-related, systems and bulk tonnage gold deposits, including vein, skarn (or replacement) and VMS prospects. Grassroots, advanced and minesite exploration projects occurred along a northwest-trending belt, centred on early Jurassic alkalic intrusions, from the Horsefly area north to Maud Lake. Exploration for lode gold deposits continued in historic placer and/or lode gold camps, such as Wells-Barkerville, Keithley Creek and Spanish Mountain (CPW).

International Wayside Gold Mines Ltd. completed a rehabilitation program on the 1200 level at the old **Cariboo Gold Quartz (CGQ)** mine, a former

gold producer located near Wells. In addition, more than 1900 metres of underground percussion and surface diamond drilling was completed in an attempt to prove up bulk tonnage and open pit reserves, on a series of northwest-trending zones (Pinkerton, Sanders, Heustis and Rainbow) that host auriferous replacement, quartz stockwork or quartz vein mineralization. Grades typically range from 1.0 to 2.0 g/t Au over several metres. The most encouraging drill intersection to date was in percussion hole U96-03 which averaged 3.3 g/t Au over 18.3 metres. Narrow, high grade veins, the mainstay of past mining operations, were also encountered. The company did not proceed with a planned and permitted 10 000 tonne bulk sample.

Near Likely, Cyprus Canada Inc. completed a 2600-metre trenching program to evaluate the **Spanish Mountain** property for its potential to host a bulk tonnage gold deposit. Eight trenches were excavated across the primary fabric of Nicola Group graphitic shales, mudstones and siltstones (which trend northwest and dip moderately northeast). The shaley units are typically folded and intensely fractured. Pyrite is ubiquitous. Weathering of the rocks has resulted in the development of abundant limonitic boxwork commonly enriched in gold; primarily where the texture occurs in association with well-developed quartz stockwork zones. Assay results generally were encouraging and 3 parallel zones were identified, including a 64-metre section in trench 1 that graded 1.83 g/t gold. However, Cyprus terminated its option on the property.

The **Ace** property, owned by Barker Minerals Limited, is 34 kilometres northeast of Likely. The property consists of more than 440 units that cover an area between Clair and Ishkloo creeks, northeast of Mount Barker and just south of the Little River. The claims cover an 8-kilometre long, east-trending angular float train of gold-enriched massive sulphide and quartz-sulphide vein material. There are few bedrock exposures on the property, but the underlying rocks belong to the Downey Succession, part of the Paleozoic Snowshoe Group. They consist of quartzite, quartz-sericite schist, greenstone, amphibolite, graphitic schist and dirty limestone units that strike northwesterly and dip moderately to steeply to the northeast. Magnetometer, VLF-EM and soil sampling surveys have been conducted on over 125 kilometres of cut line. Several chargeability highs coincide with gold soil geochemical anomalies that have a northwesterly trend, parallel to the boulder train, across the property. Trenching of the anomalies was conducted late in the year. The Ace property may represent a volcanogenic massive sulphide system (Besshi-type?) similar to the Goldstream deposit, which is a new deposit type for the

area. It may also have been a potential lode gold source for some of the historic placer deposits.

Kinross Gold drilled 2 holes on the **Maud** property, 10 kilometres northwest of QR, to test for QR-style gold mineralization on the margin of a monzodiorite stock. Neither hole encountered significant mineralization.

Imperial Metals was involved in several exploration projects in the region. South of Mitchell Bay, on the **Redgold (Shik)** property, the company conducted a modest trenching and diamond drilling program to test gold-copper porphyry mineralization discovered in a small granite quarry. Fracture-controlled and disseminated chalcopyrite, bornite and pyrite, totaling up to 3%, occur in syenitic, monzonitic and dioritic phases of the Early Jurassic Shiko Lake stock. The holes intersected either coarse-grained augite porphyry or K-feldspar altered monzonite. Several narrow intersections, grading in excess of 1% copper and several grams per tonne gold, indicate that the prospect warrants further examination and drill testing.

A 10-hole diamond drill program was conducted on the **Beekeeper** alkalic Cu-Au porphyry target, 22 km southeast of Mount Polley, by joint-venture partners Eastfield Resources Ltd. (operator) and Imperial Metals. Three holes returned encouraging assays including 30 metres grading 0.31 g/t Au and 0.20% Cu in B-96-1; and 22 metres grading 0.96 g/t Au and 0.70% Cu in B-96-3.

The **Lloyd-Nordik** property of Big Valley Resources Inc. adjoins the Mount Polley property on the north and east. It includes a very promising copper-gold prospect called the Lloyd 2 zone, which occurs on the northern margin of the Mount Polley stock, a high-level alkalic intrusion. The Lloyd 2 zone has a minimum strike length of 250 metres along its northeast trend and appears to dip steeply to the northwest. It is composed of several lenses that diverge from north to south. Mineralization is concentrated in intensely K-feldspar altered volcanic and dioritic to monzonitic intrusive rocks near their contacts. High grade copper and gold values are commonly present in zones of spectacular magnetite-healed crackle breccia. Chalcopyrite and pyrite formed in open spaces following deposition of magnetite. The current phase of exploration began in 1993 and extensive drilling in 1996, to within metres of the Mount Polley claim boundary, has enabled the company to produce a measured-indicated resource for the Lloyd 2 zone of 2.5 million tonnes grading 0.55% Cu and 0.39 g/t Au, at a cutoff grade of 0.20% Cu.

Big Valley also conducted soil geochemical, I.P. and magnetometer surveys on the **BV** group of claims, north of Gavin Lake and 10 kilometres west of the Lloyd 2 zone. An area anomalous in copper, molybdenum and gold was identified. Trenching and diamond drilling are planned for 1997.

NORTHERN QUESNEL TROUGH

The number of companies active in the area increased in 1996. Most programs targeted Cu-Au porphyry deposits, Au-enriched skarns or epithermal vein systems.

AGC Americas Gold Corporation completed a 6100-metre diamond drill program on the **JD** epithermal gold prospect in the Toadoggonne region of northern B.C. Drilling focused on extending and further defining the Finn zone, which has been traced by drilling for more than 350 metres in an easterly direction. The zone averages approximately 9 metres in thickness and has been interpreted to have a moderate north-northeast dip. Host rocks are green to maroon flows, breccias, tuffs and epiclastic rocks belonging to the Metsantan Member of the Toadoggonne Volcanics. Two styles of mineralization are present: typical epithermal mineralization consisting of weakly banded chalcedonic quartz veins with traces of disseminated sulphides, native gold and wire silver, and Au-enriched semi-massive to massive sulphide veins, up to 5 metres wide. Assays from recent diamond drilling include 14 metres grading 3.74 g/t Au (ddh JD96-157) and 10 metres averaging 4.73 g/t Au (ddh JD96-158). The most recent drill results suggest that the Finn zone has more potential for a low grade, bulk tonnage gold deposit with local, narrow, high-grade gold, bonanza-style veins. Pervasive epidote alteration with local K-feldspar veining, observed in many of the deeper holes, suggests proximity to a porphyry system.

AGC has also acquired the **AI** and **Moose** claims and the **Lawyers** property, a former gold-silver producer. Exploration programs are also planned for these properties.

Canasil Resources Inc. completed a 7-hole, 700-metre diamond drill program on the **Brenda** Cu-Au porphyry prospect in the Toadoggonne, 28 kilometres north of Kemess. The White Pass zone, a northwesterly striking system, was the main target of this years drilling program. The zone is outlined by a 900 x 200 metre Au-Ag geochemical anomaly and is adjacent to a large alteration zone consisting mostly of alunite. Host rocks consist of K-feldspar flooded quartz monzonite of suspected Early Jurassic age and fine-grained, locally bleached and silicified intermediate flows of the

Jurassic Toodoggone Formation. Drill hole 96-03 intersected 108.8 metres grading 0.48 g/t Au and 0.14% Cu.

Modest exploration programs in the Toodoggone took place on the **Firesteel**, **Oxide Peak** and **Golden Lion** properties.

Consolidated North Coast Industries Ltd. explored 3 properties in the northern Omineca Mountains for their copper-gold porphyry potential. They are, from north to south, **McGold**, **Goldvale** and **Redgold** (Tundra) properties. Each claim group covers a segment of a northwest-trending magnetic high as well as east-northeast trending structures. McGold and Goldvale occur along a magnetic high that corresponds with the McConnell Range, and Redgold overlies a similar feature on the southern end of the Swannell Range. The properties are very well positioned along the Omineca Resource Access Road (ORAR), and south of the Kemess South mine development.

On the **McGold** property, disseminated and fracture-controlled sulphides occur in hornfelsed and/or biotite altered intrusive rock in association with a dioritic stock.

Goldvale is a grassroots project. The ground was staked based on gold stream-sediment anomalies.

The **Redgold** prospect consists of a series of sheeted quartz veins that contain up to several percent copper and up to 5 g/t Au. However, mineralization occurs only in the veins, which are up to 0.5 metres wide.

The projects met with mixed results and only Goldvale (1 hole) and Redgold (6 holes) were drilled.

Joint venture partners International Conquest Exploration Ltd. and Major General Resources Ltd. completed a 5-hole diamond drill program on the Pacific Sugar zone (**Joh** property), a strataform, gold-enriched, massive magnetite skarn occurrence located 8 km south of Johanson Lake. The zone is oriented approximately west-northwest, dips 40° to the south and is in excess of 5 metres thick. Semi-massive magnetite, with traces of pyrite and chalcopyrite, occurs in a well developed skarn consisting of brown garnet, green diopside, epidote and calcite. The immediate hanging wall is recrystallized, fossiliferous limestone, part of the Triassic Takla Group, which consists mostly of augite phryic flows and tuffs. These are cut by a dioritic intrusion of suspected Jurassic age. Geochemically anomalous copper and gold values were reported in 4 holes that intercepted the zone. A 9.4 metre intersection through the zone, in hole 96JOH-2, averaged 2703 ppm Cu and 536 ppb Au.

Lucero Resource Corp. completed airborne mag/em survey, ground mag and vlf-em surveys and extensive soil sampling on the **Gold** claims, just east of Asitka Peak. The company is exploring the area for Au-enriched magnetite/copper skarns.

A 6-hole, 700-metre diamond drill program was completed on Stratabound Minerals Corp. **Swan** Zn-Pb-Ag prospect in the Swannell Range, east of Aiken Lake. The occurrence is reported to be structurally-controlled and of Mississippi Valley-type.

Catalyst Ventures Corporation reported that drilling by Battle Mountain Gold Company on the **Mariposite** joint venture project had been shut down because of early winter-like conditions. Two holes were completed and assay results have not been reported.

Vital Pacific Resources Ltd. completed a 9-hole diamond drill program on the **Soup** property, located in rugged mountainous terrane 15 kilometres south of Johanson Lake. The company tested several northeast-trending mineralized structures as well as stratabound, gold-enriched magnetite skarn zones. The target area is on the east side of the Hogem batholith and host rocks are Takla Group augite porphyry flows and tuffs. The best results of the program were from 2 holes drilled to intersect mineralized structures on the Gulley zone. A 30-metre intersection in hole 96-1 averaged 5.5 g/t Au and a 6-metre intersection in hole 96-2 graded 6.8 gpt Au. The results were encouraging enough to prompt a second phase of drilling which was suspended because of severe winter-like conditions. The follow up program will resume in the spring of 1997.

Lysander Gold Corporation released encouraging diamond drill assays from a 10-hole program on the **Lorraine** copper-gold porphyry prospect located northwest of Germansen Landing in the Swannell Ranges. Drilling focused on the Bishop, Eckland, Upper Main and North Cirque zones. Good grade intercepts on the Bishop zone were encountered at depths of greater than 100 metres. The best intercept on the Upper Main zone averaged 0.84% Cu and 0.30 g/t Au over 128 metres. The Lower Main zone was not tested but is part of a combined geological resource for the Main zone that totals 10 million tonnes grading 0.7% Cu and 0.1 g/t Au. The company also continued with its successful geochemical sampling program which consists of collecting talus fines at mid-slope elevations and seeps at the base of slopes. Lysander strengthened its position in the area by acquiring, on option and by staking, several additional claim blocks adjacent to their Lorraine and Boot Steele properties.

Teck Exploration Ltd. conducted a modest trenching and sampling program on the **Lustdust** gold-bearing polymetallic skarn-manto prospect, 35 kilometres northeast of Takla Landing. The prospect is west of the Pinchi fault and occurs in Cache Creek Group rocks near the margin of the Hagem batholith. Teck plans to return to the property to conduct a modest diamond drilling program next year.

Eastfield Resources released results from a 9-hole, 514-metre drill program on the Lake Copper zone, **Indata** property. The best results were from ddh96-1 where a 97.5 metre intersection averaged 0.122% Cu. No gold assays were released. A supplemental program including additional drilling has been proposed.

Birch Mountain Resources Ltd. conducted a 6-hole, 1850-metre diamond drill program on the **Eagle** Cu-Au porphyry prospect in the Nation Lakes area and reported mixed results. In the immediate area Hudson Bay Exploration was also busy exploring for bulk tonnage, copper-gold mineralization on the Tchentlo property.

Abitibi Mining Corp. completed a small diamond drill program on the **Rainbow** property in the Phillip Lakes area west of Mackenzie. Drilling followed encouraging results from an I.P. survey completed earlier in the year. The program was designed to test for a Cu-Au porphyry system on the Christina Jean and CJ 1-10 claims (on option from Dave Forshaw).

NECHAKO PLATEAU

Exploration in this area has focused mainly on epithermal gold prospects and porphyry-related base metal and gold deposits. The most recent discoveries in the area continue to receive most of the attention, although companies have returned to re-investigate deposits first discovered more than a decade ago. Eocene and Late Cretaceous epithermal gold systems are now known to occur in the region and it is the latter that have produced the most encouraging results.

Teck Exploration completed a 23-hole, 3400-metre diamond drill program on the **Tsacha** epithermal gold prospect in the Tommy Lakes area. It was the third drill program on the property since discovery of the vein system in 1994. Past drilling focused mainly on the Tommy vein, the most significant mineralized structure discovered to date, which has been traced along strike for 640 metres and averages 4 metres in width. Drilling in 1996 mainly targeted several of the subsidiary veins known on the property. The Johnny vein may be the next most significant vein on the

property. Drill results include a 5.9-metre intersection (true width) grading 3.0 g/t Au. Several new veins were discovered during the year, but have not been adequately tested. The down-dip extension of the vein system appears to be limited. It is cut by a shallow, southwest (?) dipping Late Cretaceous felsite sill. The vein system is truncated to the south by a west-southwest trending structure.

In February, 1997, Teck Exploration made public the results of a resource calculation for the Tommy vein based on over 2-dozen drill intercepts. The resource estimate, using a cutoff grade of 3 g/t Au, is 478,600 tonnes grading 8.7 g/t Au and 82.3 g/t Ag.

A similar vein system crops out immediately to the east on the **Tam/Taken** property, owned by Phelps Dodge Corporation of Canada, Limited. The vein system on the Tam/Taken property consists of the Ted and Mint showings. The Ted vein has been traced at surface for about 300 metres along its northerly strike and averages 3 to 4 metres wide. A 9-hole, 1263-metre diamond drill program tested the two known showings at depth. No assay results have been released.

Phelps Dodge also investigated the **Laidman** property, east of Johnny Lake. The occurrence consists of narrow, quartz-sulphide veins that are oriented in a westerly direction. The veins are hosted by a granite phase of the Early Cretaceous Capoose batholith that is quartz-sericite and clay-altered and contains 1-2 % disseminated pyrite. The system appears to be high level, high temperature and high sulphidation. In addition, Phelps Dodge conducted modest exploration programs on the **Cutoff, Yellow Moose, Clisbako** and **Holy Cross** properties.

Lucero Resource Corp. completed a 9-hole diamond drill program on the **Wolf** epithermal gold property east of Entiako Lake. The program tested the down-dip extension (*i.e.* to the west) of the Ridge zone with three fences of 3 holes each. Most of the drill assays were not encouraging. The best intersection assayed 5.05 g/t Au and 34.3 g/t Ag over 1.52 metres. No further work is planned for the immediate future.

Kennecott Canada Exploration Inc. continued to explore the **Blackwater-Davidson** porphyry-related precious-base metal prospect near Mt. Davidson. The company expanded the existing grids and added I.P. coverage over several areas of the property. Alteration mineralogy and hornfelsing suggest proximity to a buried intrusion. Kennecott also further evaluated the **Java** molybdenum porphyry prospect, north of Tatelkuz Lake.

Blackstone Resources Inc. drilled the Rutt and Christmas Cake zones on the **Buck** property, west of

Fawnie Creek. Overall, assay results were discouraging. Other companies, including Orvana Minerals Corp. on the **CH** copper porphyry prospect, were active in the region.

OTHER AREAS

Imperial Metals completed a 5-hole, 460-metre diamond drill program on the **Chaco Bear** copper-silver-gold porphyry-related prospect, west of Bear Lake. Imperial Metals is encouraged by the results and plans to return to the property next year to conduct more drilling. Immediately south of Chaco Bear, International Skyline Gold Corp. conducted a modest, but successful diamond drill program on the **Bear Lake** copper-molybdenum prospect. The best intersection was in hole 96-14 which averaged 0.32% Cu and 0.106% MoS₂ over its 140-metre length.

Spokane Resources Ltd. completed 2 phases of diamond drilling on the **Mac** molybdenum-copper porphyry prospect, 100 km north of Endako. In total more than 6200 metres of drilling was completed in 28 holes. The majority of the drilling has focused on the Camp zone and the company feels that the zone has the potential for an economic Mo-Cu deposit in excess of 100 million tonnes. Molybdenum and copper mineralization occur both within volcanics and a quartz monzonite intrusion. Higher grades occur within the volcanics along the northwest (Northwest Contact zone) and east contacts (East Contact zone) of the intrusion. Drill hole 96-27 on the East contact zone averaged 0.203% Mo and 0.214% Cu over 165.8 metres. Diamond drilling on the Peak zone encountered fracture-controlled copper and molybdenum mineralization in an intensely altered porphyritic intrusion. The Peak zone is the southern of three distinct zones that comprise the Mac porphyry system (the third zone is the Pond). The Peak zone has a geophysical signature measuring 1 km north by 0.5 km east. A 5000 metre diamond drill program is planned for early 1997.

Pine Valley Coal Ltd., operator for the BCR Ventures Inc., Falls Mountain Coal Inc. and Mitsui Matsushita Canada Ltd. Joint Venture, conducted two phases of drilling on the **Willow Creek** coal property, 75 kilometres northeast of Mackenzie, focusing mainly on proving up additional reserves on the Willow East and Willow West deposits. More than 10 000 metres of rotary drilling was completed, along with trenching and bedrock mapping. The low volatile coal measures are in the upper and middle members of the Gething Formation on the northeast limb of the Coal River

anticline. Seven coal seams have a combined thickness of 20 metres. The largest seam is 7 metres thick. A feasibility study has been initiated and will be completed this year. Initial plans call for annual production of 600,000 tonnes of clean coal per year over a mine life of 15 years. Estimated employment is 80 to 100 people and the operation would use existing transportation infrastructure.

INDUSTRIAL MINERALS

Ava Resources Inc. is poised to proceed with a quarry operation at the **Wishaw Lake** quartzite deposit, located 4 hours east of Prince George in the Kakwa Recreation Area. The site, worked unsuccessfully in the early 1980s, occurs in a valley immediately north of Wishaw Lake. Pink to white quartzite of the Lower Cambrian Mahto Formation (Gog Group), crops out continuously from near the lake northward for at least 200 metres. In 1996 the company upgraded the road access and prepared the site in advance of quarrying which will proceed in 1997.

Several prominent exposures of white, well-bedded quartzite occur on the **Alroy** claims, 40 km northwest of McBride, owned by Silver Spur Resources Ltd. The exposures are in close proximity to rail and to the Yellowhead highway. Geochemical analyses of several samples indicate that silica content is high with analyses ranging in the 97-99% SiO₂ range.

OUTLOOK

Exploration activity in 1997 is expected to remain strong in the region and maintain or surpass 1996 levels. Construction at the Kemess South and Mount Polley mines, coupled with the start-up of Mount Polley in the spring, will continue to spur exploration for gold-enriched copper porphyry deposits throughout the Quesnel Trough. The search for additional reserves at the QR and Gibraltar minesites will likely increase. Expanded exploration programs are anticipated for some of the more advanced stage projects, such as Cariboo Gold Quartz, and for less advanced projects that enjoyed success in 1996, such as Soup, Mac, JD and Lorraine. Exploration is expected to continue at last years levels in the Gataga district. A new lake sediment geochemical release for the Pinchi Lake area may lead to staking and generate some grassroots exploration. The release of Regional Geochemical Survey data for the Toodoggone River (94E) and McConnell Creek (94D) mapsheets, in late June or early July, 1997, also is expected to stimulate exploration.

EXPLORATION AND DEVELOPMENT HIGHLIGHTS SOUTH-CENTRAL BRITISH COLUMBIA - 1996

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HIGHLIGHTS

- Exploration expenditures up to about \$21 million from \$12.4 million in 1995.
- Drilling activity up to about 120 000 metres from 72 000 metres in 1995.
- Junior companies were responsible for more than 80% of spending. Exploration by major companies was mainly confined to minesites.
- A \$13.5 million feasibility-scale drilling, geotechnical and environmental program is underway at the Prosperity copper gold project (Fish Lake).
- Large drilling projects at Getty North, Elk and Crow-Rea projects and at Copper Mountain and Afton-Ajax mine targets.

TRENDS IN EXPLORATION ACTIVITY

1996 was a relatively good year for exploration in the South-Central region. Most exploration indicators showed positive trends in activity compared to previous years. Of continuing concern is the near absence of spending by major companies (except at minesites) and the low level of exploration on grassroots targets.

Spending on exploration and development was up strongly to about \$21 million - back up to the levels seen in the late 1980s (Figure 1). As in previous years a few large projects accounted for the majority of spending. One project, **Prosperity**, accounted for more than one third of all spending this year. Exploration continues to be dominated by junior companies. Work by large companies was mainly confined to minesite properties at Afton-Ajax, Copper Mountain, and Highland Valley. Unfortunately, grassroots exploration spending is still weak, accounting for only about 17% of spending (Figure 2). Most funding is directed towards long held or well known, advanced-stage properties. In terms of target types, the vast majority of spending was directed at porphyry and related deposits with precious metal veins a distant second. Very little

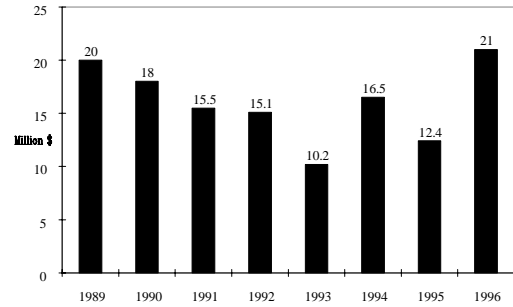


Figure 1. Annual exploration spending, South-Central Region

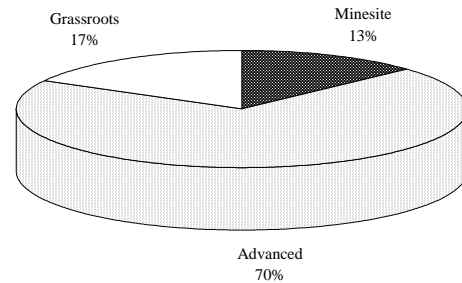


Figure 2. Percentage breakdown of 1996 exploration spending by category of work program

funding was directed to stratiform base metal or industrial mineral targets (Figure 3).

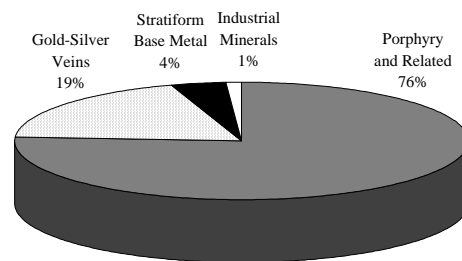


Figure 3. Percentage breakdown of 1996 spending by target type

The number of major projects was up to 28 from 23 in 1995 (Figure 4). (A major project is defined as one involving mechanical disturbance and with expenditures over \$100 000).

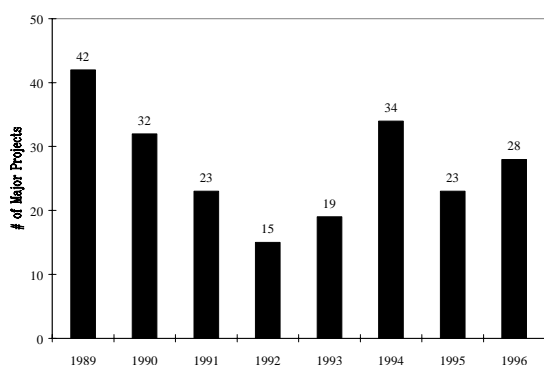


Figure 4. Number of major exploration projects per year, South-Central region

Drilling activity was also ahead strongly in 1996 to about 120 000 metres (Figure 5). This figure emphasises the relative strength in spending on advanced projects and minesite exploration projects. Again, a large proportion of this total was due to the Prosperity project, where nearly 28 000 metres was drilled during the year.

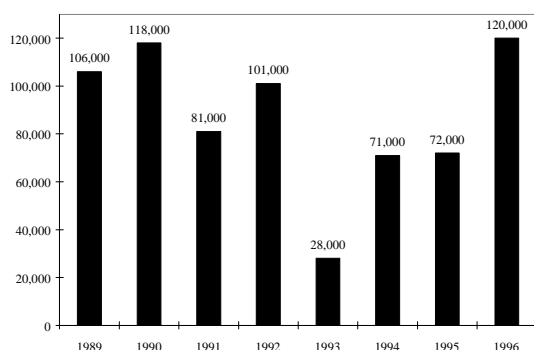


Figure 5. Meters of exploration and development drilling per year, South-Central Region

EXPLORATION ACTIVITY

Major exploration projects are listed in Table 1 and their locations are shown in Figure 6.

PORPHYRY CU-MO-AU AND RELATED TARGETS

The **Prosperity** project (Fish Lake deposit) of Taseko Mines Ltd. was one of the largest exploration projects in the province in 1996. This feasibility-scale program is expected to be completed by spring, 1997 and is budgeted at \$13.5 million. Work includes angle drilling, geotechnical drilling, pilot plant metallurgical and process studies and environmental and socio-economic baseline studies. Mineable reserves defined prior to the current program stand at 675 million tonnes grading 0.23% Cu and 0.45 g/t Au. A mine proposal is

being reviewed under the Environmental Assessment Act.

A 1994 test program of oriented core and angle drilling suggested that previous vertical drill holes, on which the reserve is based, were oriented subparallel to the mainly subvertical vein sets, and therefore, underestimated the actual grade of the deposit. The current -45 degree angle drill program is designed to intersect the vein sets at a more optimal angle to confirm a predicted grade enhancement of 11% for gold and 4% for copper and to improve the overall confidence in the reserve.

Getty Copper Corporation controls a large property located within the Guichon Creek batholith about seven kilometres north of the Highland Valley Copper mine. It conducted a large exploration project on the **Getty North** (Krain), **Getty South** (Trojan-South Seas), **Getty West** (Transvaal) and other targets during the year. Most of the work was focused at Getty North where definition and exploratory drilling, metallurgical studies and geochemical and geophysical surveys were done. Based on this drilling the company released a resource figure for Getty North in early 1997 of 35 million tonnes grading 0.47% copper including an oxide resource of 7 million tonnes grading 0.60% copper.

Late in 1996 and in early 1997, Getty announced encouraging results from a new, deep northwest extension to the deposit. After a short Christmas break drilling began again in January with five rigs.

South of Logan Lake and also in the Guichon Creek batholith, Alhambra Resources Ltd. intersected good copper values in drilling on the **Dot** property. Intersections such as 98 metres grading 0.55% Cu and 37.2 metres grading 1.23% Cu were returned from a new zone which has been traced for at least 200 metres in a southeasterly direction from a deposit reported to contain about 2.6 million tonnes grading 0.5% Cu. Assays for Mo, Au and Ag are awaited from the recent drilling.

West of Summerland, the **Crow-Rea** Mo-Cu porphyry property was tested with over 12 000 metres of diamond and percussion drilling by partners Verdstone Gold Corp. and Molycorp Gold Corp. At the **Webb Site** zone, a 2-4 metre thick, shallowly dipping quartz vein/felsic dyke (?) containing coarse molybdenite has been tested by more than 70 short, tightly spaced holes. The companies released a drill indicated reserve estimate of 500 000 tonnes grading 0.302% MoS₂ for this zone. They also drilled several



Figure 6. Location map of major exploration projects, south-central region, 1996

TABLE 1. MAJOR EXPLORATION PROJECTS, SOUTH-CENTRAL REGION 1996

Property	Operator	MINFILE Number	Mining Division	NTS	Commodity	Deposit Type	Work Done
Alabama, Oronoco & SP Zones	Princeton Mining Corp.	92HSW001, 2, 3, 8, 11, 13	Similkameen	92H/07E	Cu, Au, Ag	Alkalic Porphyry	61 ddh, 10,403 m
Ample Goldmax	Homestake Canada Inc.	none	Lillooet	92J/09E	Au	Mesothermal Vein	14 ddh, 1814 m; 4400 m road; geol; geochem
Au	George Res. Co. Ltd.	92HNE171	Nicola	92H/15E	Au, Ag, Cu	Vein	6 ddh; trenching; geochem; geophys; geol
Blackdome Mine	Claimstaker Resources Ltd.	92O 051, 52, 53	Clinton	92O/08W	Au, Ag	Epithermal Vein	18 m drift; 12.8 m raise; 20 sfc ddh, 1500 m; trenching, geochem; geol
Brett	Huntington Resources Inc.	82LSW110	Vernon	82L/04E	Au, Ag	Epithermal Vein	500 t bulk sample of RW vein; 54 m u/g drifting; 7 m raising; u/g rehab
Comet - Davenport	Teck Exploration Ltd.	92INE026, 30	Kamloops	92I/09W	Cu, Au, Ag	Alkalic Porphyry	39 ddh, 7054 m; geophys; geol
Cottonbelt	CanQuest Resource Corp.	82M 086	Kamloops	82M/07W	Pb, Zn, Cu, Ag	Stratiform	4 ddh, 1349 m
Crow-Rea (Lori)	Verdstone Gold Corp. / Molycorp Gold Corp.	92HNE138	Osoyoos	92H/09E	Mo, Cu	Porphyry	83 ddh, 9394 m; 31 pdh, 2800 m; 12 trenches, 900 m; geophysics; geochem

Property	Operator	MINFILE Number	Mining Division	NTS	Commodity	Deposit Type	Work Done
Dot	Alhambra Resources Ltd.	92ISE023, 93	Nicola	92I/07W	Cu, Au, Ag, Mo	Porphyry	16 ddh, 3130 m; geophys; geol
Ed 1 - 2, WJM & TS Claims	Foran Mining Corp.	82M 064	Kamloops	82M/05W	Cu, Zn, Pb, Ag, Au	Vein	7 ddh, approx. 900 m
Elk (Siwash North)	Fairfield Minerals Ltd.	92HNE134, 137, 096, 111	Similkameen	92H/16W	Au, Ag	Mesothermal Vein	91 ddh, 6873 m; shipped approx. 2700 tonnes ore
Galaxy	Teck Exploration Ltd. / Getchell Resources Inc.	92INE007	Kamloops	92I/09W	Cu, Au, Ag	Alkalic Porphyry	32 ddh, 4080 m; geol
Getty North, South etc.	Getty Copper Corp.	92INE038, 40, 41, 43, 136)	Kamloops	92I/10W	Cu	Porphyry	61 ddh, 15,171 m; ; geochem; geophys; geol; metallurgical studies
Groundhog Basin	Orphan Boy Resources Inc.	82M 167	Revelstoke	82M/09W	Au, Ag	Mesothermal Vein	17 ddh, 923.5 m; geochem; prosp
Hail - Harper Creek	American Comstock Explorations Ltd.	82M 009	Kamloops	82M/12W	Cu, Mo, Au, Ag	Stratiform Disseminated	8 ddh, 2847.4 m; geophys
Highland Valley	Highland Valley Copper	92ISW012	Kamloops	92I/06E	Cu, Mo, Au, Ag	Porphyry	8 ddh, 3702 m; geophys
Klinker	Okanagan Opal Inc.	82LSW125	Vernon	82L/05E	Opal	Industrial Mineral	316.5 tonne bulk sample; 1 trench; 3 test pits; 2.15 km road
Microgold	CanQuest Resource Corp.	92ISE134	Kamloops	92I/08W	Au, Ag	Epithermal Vein	5 ddh, 1169 m; geochem; geophys
Pellaire	International Jaguar Equities Inc.	92O 045	Clinton	92O/04E	Au, Ag	Mesothermal Vein	U/g test mining; 900 t bulk sample shipped to Trail smelter
PGR	Cambridge Minerals Ltd.	92P 137	Kamloops	92P/09W	Au, Ag, Pb, Zn, Cu, Mo	Vein / Porphyry	7 ddh, 382 m; 11 rcdh, 604 m; 2800 m road
Prosperity (Fish Lake)	Taseko Mines Ltd.	92O 041	Clinton	92O/05E	Cu, Au	Porphyry	68 ddh, 27,660 m; geotechnical and environmental baseline studies
Rain	Select Ventures Inc.	82M 156	Revelstoke	82M/08E	Cu, Zn, Pb, Ag	Volcanogenic Massive Sphide	3 ddh, 900 m
Rainbow	Teck Exploration Ltd. / Getchell Resources Inc.	92INE028	Kamloops	92I/09W	Cu, Au, Ag, Mo	Alkalic Porphyry	13 ddh, 1980.8 m
Reliance	Menika Mining Ltd.	92JNE033, 136	Lillooet	92J/15W	Au, Ag, Sb	Mesothermal Vein	13 ddh, 2387 m
Rose Munro Lake	Almaden Resources Corp.	82ENW021	Osoyoos	82E/12W	Cu, Mo, Au, Ag	Porphyry	7 ddh, 1780; 4 trenches; 750 m road; geophys
Skinner	Ottarasko Mines Ltd.	92N 017	Clinton	92N/09W	Au, Ag	Mesothermal Vein	400 t bulk sample; 12 m raising
Watson Bar (Second Cr)	Stirrup Creek Gold Ltd.	92O 051, 110	Clinton	92O/01E	Au, Ag	Epithermal Vein / Disseminated	14 ddh, 1650.3 m; trenching, geochem; geol
Wen	George Resource Co. Ltd.	92HNE058	Nicola	92H/16W	Au, Ag, Cu	Vein	10 ddh; trenching; geochem; geophys; geol

deeper holes which intersected wide intervals of weakly disseminated molybdenite in relatively fresh granitic rocks.

A few kilometres to the north on the **Rose Munro Lake** property, Almaden Resources Corp. drilled 7 holes, completed IP surveys and staked a large westerly extension to their claim block. The widely spaced drill holes, aimed at testing a very large, strong IP anomaly, were successful in intersecting anomalous Cu-Mo in a porphyry setting. A four kilometre long extension to the IP anomaly was outlined and covered by new claims. This area is heavily till covered and there is good potential for discovery of a Brenda-style porphyry deposit.

GOLD-SILVER TARGETS

Two new high-grade gold-silver vein discoveries were tested by drilling in 1996 (**Ample Goldmax** and **WD** vein at Elk property) and several other targets were advanced by drilling or underground work (e.g. **Blackdome**, **Watson Bar**, **Microgold**, **Groundhog Basin** etc.). Three other high grade vein deposits, **Brett**, **Pellaire** and **Skinner** were tested by bulk sampling programs and these are discussed below under "Bulk Samples".

In the Cayoosh Creek drainage near Lillooet, Homestake Canada Inc. drilled on the **Ample Goldmax** property to test a new mesothermal gold vein discovery made recently by prospectors Dave Javorsky and Gary Polischuk. Gold occurs in narrow, subhorizontal quartz veins associated with arsenopyrite and lesser pyrrhotite, pyrite and chalcopyrite in phyllitic shale and greenstone of the Brew Group.

A large drilling program resulted in the discovery of the **WD** vein by Fairfield Minerals Ltd. on their Elk property east of Merritt. The new vein is located 200 metres north of and parallel to the **Siwash North** vein which has produced over 51 000 ounces of gold between 1992 and 1995. During 1996, Fairfield shipped the remaining 2700 tonnes of high-grade stockpiled Siwash North ore to a smelter for processing.

At the closed **Blackdome** gold-silver mine, Claimstaker Resources Ltd. conducted drifting and raising on several potentially mineable ore shoots of typical epithermal mineralization on the #11 and #1 veins. Surface trenching and drilling was done on several other targets including the #2 vein, Giant vein and the Southeast Rhyolite target.

Stirrup Creek Gold Ltd. did surface trenching and closely spaced drilling at Zone V on the **Watson Bar** epithermal gold project. Located north of Lillooet

and west of the Fraser River, the Watson Bar property sits at the southeast end of a 15 km trend of Au-As-Sb-Hg-Cu-Pb-Zn prospects. At Zone V gold occurs in a shallowly dipping zone comprised of quartz-arsenopyrite veins, carbonaceous thrust fault material and altered sandstone of the Lower Cretaceous Jackass Mountain Formation. Both high-grade zones (e.g. 3.66 metres grading 26.7 g/t Au) and wider, lower grade zones have been intersected. The mineralization has some similarities, and key differences also, with "Carlin-type" or "sediment hosted bulk mineable gold deposits".

STRATIFORM BASE METAL TARGETS

Exploration for stratiform base metal deposits picked up slightly in 1996 but is still woefully low considering the high potential for these deposits in Eagle Bay, Kootenay Arc, Shuswap and other rocks in the region. Only three properties had significant projects.

The unusual volcanic-hosted, disseminated, stratabound copper mineralization at the **Hail - Harper Creek** deposit was the focus of an eight hole drill program by American Comstock Explorations Ltd. This deposit, which has a resource of 96 million tonnes grading 0.41% Cu, was optioned from subsidiaries of Noranda and US Steel. Prior to this year it had not been drilled since the early 1970s. At the time of writing, results have only been released for one hole which intersected 171 metres grading 0.31% Cu. The deposit is open in three directions and given the continuity of mineralization, it appears that an increase of the current tonnage is possible.

Near the Goldstream mine, Select Ventures Inc. drilled three holes on the **Rain** Besshi-type massive sulphide prospect. Results are pending.

At the **Cottonbelt** stratiform Pb-Zn-Ag prospect north of Shuswap Lake, CanQuest Resource Corp. completed 3 long holes in their pursuit of Broken Hill-style mineralization at the core of the Mt. Grace syncline. No significant mineralization was encountered, although the company collected important new structural information on the likely position of the fold nose. Additional deep drilling is planned for 1997.

INDUSTRIAL MINERALS TARGETS

There were no major exploration programs for industrial minerals in 1996, except for the **Klinker** opal project described below under "Bulk Samples". The Quinto Mining Corporation applied for a small mine permit for its **Lumby** graphite-sericite project. At year

end the 24 000 per year mine proposal was still before the South-Central Mine Development Review Committee. Approval of this project is expected early in 1997.

The **Crystal Peak** garnet quarry proposal located near Apex Mountain is still being reviewed by the Environmental Assessment Office. A further round of public meetings is tentatively planned for 1997.

OPERATING MINES AND QUARRIES

1996 was a difficult year at the operating metal mines in south-central B.C. The collapse of copper prices, high operating costs and/or depletion of economic reserves caused three out of five of the operating mines in the region to close during the year. The **Nickel Plate** mine closed permanently in October, 1996 while **Goldstream** and **Similco** mines were put on care and maintenance in January and November respectively. A fourth mine, **Afton-Ajax** will close permanently by mid 1997.

Highland Valley Copper is the bright spot in the region. The open pit copper-molybdenum-gold-silver mine was highly profitable in the first 6 months of the year, despite marginally lower mill throughput. The current mine plan would see depletion of ore reserves in 2008. Over the last several years exploration has been directed at drill testing for deeper mineralization beneath the final Valley pit. The company recently announced a potential resource in this area of 350 million tonnes grading 0.384% Cu at a stripping ratio of about 1.3:1, sufficient for about 7.5 years of production at the current milling rate. Mining of this resource would require a substantial pushback of the Valley pit walls. This zone appears to offer the best opportunity to extend the mine life.

The **Goldstream** copper-zinc mine closed on January 31, 1996 due to depletion of economic reserves. Although high-grade, Besshi-type VMS mineralization is still present in and below the lower workings of the mine, the cost of decline haulage to surface became prohibitively expensive. Imperial Metals Corp. will maintain the mill on care and maintenance pending improved economic conditions, custom milling opportunities and/or discovery of new mineralization in the area. No exploration took place at Goldstream in 1996.

Mining ceased in July, 1996 at the **Nickel Plate** open pit gold mine of Homestake Canada Inc. although milling of stockpiled ore continued until October 25. The mine is being permanently closed due to depletion of economic reserves and reclamation is well underway. Since 1987 the mine produced about

800 000 ounces gold. That is on top of about 1.5 million ounces produced from various gold skarn orebodies in the district between 1898 and 1955.

At the open pit **Similco** copper-gold mine of Princeton Mining Corp, production in 1996 was from the Ingerbelle pit at an average grade of about 0.32% copper. The mine was put on care and maintenance in November due to high operating costs and low copper prices. The company conducted a large exploration drilling campaign in late 1996 and early 1997 on the Copper Mountain side of the property. The goal is to define a ten year reserve of alkalic porphyry Cu-Au ore which could be produced at a copper price of US\$0.80/lb - on the order of 90 million tonnes grading 0.45% Cu at a stripping ratio of 1.5:1. Drilling was focused in three areas, the **Alabama**, **Oronoco** and **SP** targets. The SP zone is the area around Pits 2 and 3 and appears to offer the best potential. Current reserves here include about 35.4 million tonnes grading 0.33% Cu and 0.12 g/t Au at a strip ratio of 1.78:1 and 53.5 million tonnes grading 0.48% Cu at a strip ratio of 2.32:1.

The **Afton-Ajax** copper-gold mine of Afton Operating Corp., a subsidiary of Teck Corporation, also struggled during the year due to the drop in the price of copper. The operation is now scheduled to close in May, 1997. Production during the year came from the Ajax East pit, now depleted and backfilled, and the Ajax West pit. Teck Exploration Ltd. was busy during the year exploring seven different alkalic porphyry Cu-Au targets on the mine property and elsewhere in the Iron Mask batholith. Perhaps the most intriguing results came from a new discovery at the **Coquihalla West** zone adjacent to the mined-out Pothook pit. Here gold-bearing but copper-poor mineralization occurs in Nicola volcanics and Iron Mask intrusive rocks. At the **Rainbow #2** zone, Teck and Partner Getchell Resources Inc. drilled 13 holes in an attempt to improve the geological resource of 14.1 million tonnes grading 0.5% Cu which was announced last year. The partners plan a deep drilling program in 1997 to test for higher grade, breccia-hosted zones at depth. Teck and Getchell also did definition drilling on the **Galaxy** deposit a few kilometres to the east, however, Teck decided against further development.

Several small mines and quarries continued to produce marble, limestone, magnetite, fullers earth and gypsum in the region. In addition, small mine permits were issued to Mountain Minerals Co. Ltd. for production of small quantities of zeolite from its **Ranchlands Z-1 and Z-2** quarries near Cache Creek.

Approximately 2000 tonnes of vein material was mined from surface on the **Peter** vein on the **Bralorne** mine property. This material has been

stockpiled until milling commences in mid 1997. Mill construction was the main focus of work at Bralorne in 1996. A Mine Development Certificate was issued in 1995 and most permits are now in place to allow the mine to reopen.

BULK SAMPLES

Due to the 10 000 tonne bulk sample provisions of the *Mines Act*, a small bulk sampling "cottage industry" has developed in the province. The bulk sample process make it possible for individuals or companies to test the grade or marketability of their product and at the same time, generate some cash flow to fund further exploration. Several examples of these programs were active this year.

Approximately 500 tonnes of gold-bearing material was taken from a surface trench on the RW vein on the **Brett** property near Vernon by Huntington Resources Inc. The material will be shipped to a smelter. The company also completed underground raising and crosscuts into the Bonanza zone.

Also near Vernon, Okanagan Opal Inc. took a 316.5 tonne bulk sample of opal-bearing material from test pits on the **Klinker** property. The company has set up a workshop and retail outlet at Vernon where opal jewelry and specimens are produced and sold.

At **Pellaire** in the South Chilcotin Mountains, about 900 tonnes of gold-silver bearing vein material was mined by International Jaguar Equities Inc. This

bulk sample is destined for processing at the Trail smelter.

Finally, about 400 tonnes of gold-bearing vein material was mined at the **Skinner** property by Ottarasko Mines Ltd..

OUTLOOK FOR 1997

In terms of spending and metres of drilling, exploration activity will probably decline slightly in the coming year because of several very large projects are coming to an end. Nevertheless, there should be a large number of small to medium sized drilling and bulk sampling programs in 1997. It is likely that junior companies will again be responsible for most of the activity and that most interest will be directed to porphyry and vein deposits. It is hoped there will be a resurgence of interest in stratiform base metal targets, particularly in the Eagle Bay Assemblage which will be the subject of a till geochemistry data release in April, 1997.

ACKNOWLEDGEMENTS

The author wishes to thank the exploration community and the other staff members in the Kamloops office for providing data used in this review article.

EXPLORATION AND DEVELOPMENT HIGHLIGHT KOOTENAY REGION - 1996

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SUMMARY

The total of exploration expenditures in the Kootenay region in 1996 is estimated to have been \$9.9 million, compared to \$8.8 million in 1995 (Figure 1). Exploration drilling on coal properties, mainly at or close to the five producing mines in the Elk Valley, accounted for \$3.3 million, or exactly one third of the total estimated amount. Furthermore, out of an estimated total of 88 100 metres of exploration drilling in the region in 1996, 45 500 metres, or roughly 51% of the total, consisted of rotary drilling on the coal properties.

The total number of projects for which Notices of Work were submitted is 183, a marked reduction from the 280 in 1995 (Figure 2). Also, the ratio of "major" projects (with drilling, underground work, or bulk sampling) to "minor" projects (surface surveys or trenching only) is higher than in recent years. The implication drawn from a comparison of these indicators is that, although the total expenditure was higher, more money was spent on drilling and other more advanced programs on existing prospects, and less on "grassroots" exploration or preliminary work on new prospects.

The exception to that trend is in the Purcell Mountains where 1996 saw a marked increase in claim staking and preliminary surveys over large areas in response to the initial release in July of data from a \$600 000 airborne geophysical survey. The survey was financed by the British Columbia government, managed by the Geological Survey of Canada, and was flown over three highly prospective areas containing rocks of the Purcell Supergroup in which the main target is Sullivan-type, sedimentary exhalative, zinc-lead-silver mineralization. The final data were released, for the Yahk-Creston block, in March of 1997. Aggressive follow-up of the airborne geophysical data has already focussed attention on at least three areas in which new indications of Sullivan-style alteration and mineralization have been found and on which major drilling programs are anticipated for 1997.

In the process of evaluating the gold potential of a property south of Salmo which contains the workings of the former-producing Jersey and Emerald mines, Sultan Minerals Inc. has recognized a new zone of silver-lead-zinc mineralization which has impressive size potential. Other metal prospects which produced encouraging results in 1996 and are expected to see more advanced exploration in 1997 include Teck's optioned Eholt and Bear-Cub gold-copper properties near Greenwood, Kettle River Resources' new gold discovery at Summit Camp in the same area, the Old Nick nickel-cobalt prospect near Bridesville, and the Midnight-IXL gold property at Rossland. A decline has been completed at the Lexington copper-gold property south of Greenwood providing access for test mining and underground drilling. Excavation of a decline is underway at the Bull River copper-gold mine property near Cranbrook in order to provide access for bulk sampling and underground exploration drilling.

Bulk sampling and construction of a large pilot mill continued at the Black Crystal graphite prospect west of Slocan. Test results are expected soon from bulk samples collected at four kimberlite zones on Quest International's Ice diamond prospect near Elkford. Other new and promising industrial mineral prospects include a sodalite showing explored and sampled at Mount Mather northeast of Golden and a large deposit of tufa at Brisco north of Radium Hot Springs.

All five of the producing coal mines in southeastern BC expanded production in 1996 and carried out aggressive exploration drilling on or near their mine properties. The region's only producing metal mine, the Sullivan mine at Kimberley, continued steady production through the year but is now only about four years away from permanent closure due to exhaustion of its mineable reserves. All of the industrial mineral mines and quarries in the Kootenay region also maintained steady production through the year

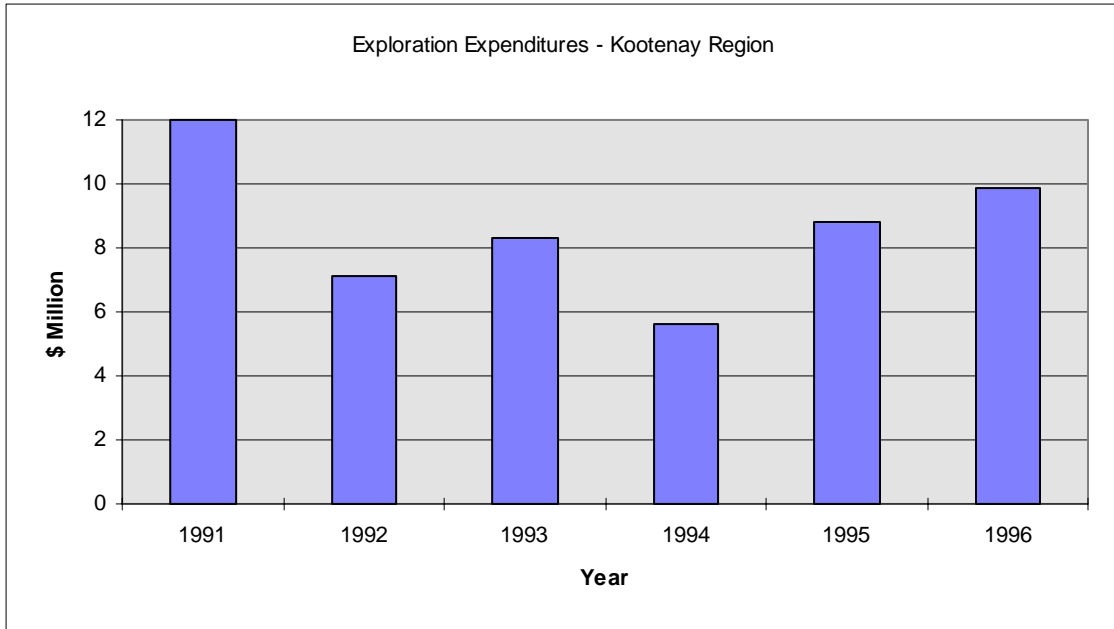


Figure 1.

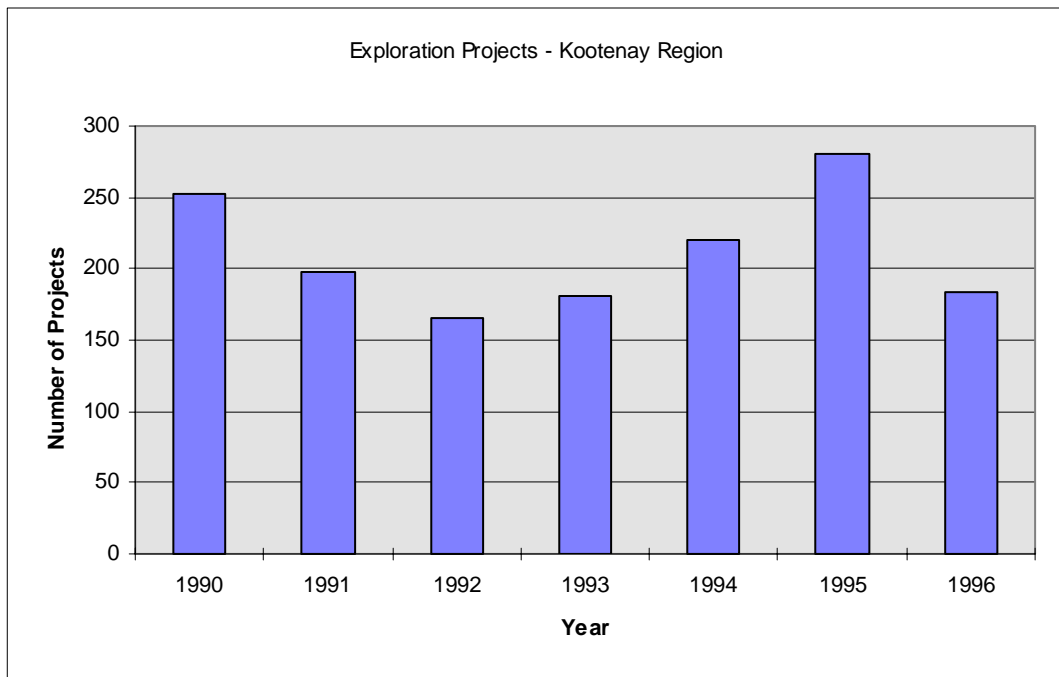


Figure 2.

Kootenay Region
Major Projects 1996

Property (Operator)	Minfile Number	Mining Division	NTS	Commodity	Deposit Type	Work Done
Albert River (Diamet Minerals Ltd.)	NA	Golden	82J/12E	W, Au, Cu	Vein	4ddh, ~1625 m; mapping
Aspen (R.H. Stanfield & Associates)	NA	Fort Steele	82G/6W	Feldspar	Magmatic	6rdh, ~1000m
Bull River (R.H. Stanfield & Associates)	082GNW002	Fort Steele	82G/11 W	Cu, Au, Ag	Vein	Commenced 1500m decline for bulk sampling program
Coal Mountain (Fording Coal Ltd.)	082GSE052	Fort Steele	82G/7E, 10E	Coal	Sedimentary	27rdh, ~ 6000m
Del (Quest International Resource Corp.)	082FSE136	Nelson	82F/2E	Zn, Pb, Ag	Sedimentary Exhalative	8ddh, ~4000m; geochemistry
Eholt/Bear Cub (Teck Corporation)	082ESE239	Greenwood	82E/2E	Au, Cu	Skarn	12ddh, 1933 m; geophysics; geochemistry
Elkview (Elkview Coal Corp.)	082GNE015	Fort Steele	82G/10 W, 15W	Coal	Sedimentary	80rdh, ~10,000 m
Findlay/Doctor Creeks (Miner River Resources / Eagle Plains Resources)	082KSE060, 081, 053	Fort Steele/ Golden	82F/16E , 82K/1E	Zn, Pb, Ag	Sedimentary Exhalative	9ddh, ~900 m; geophysics, geochemistry, mapping
Fording River (Fording Coal Ltd.)	082JSE009, 010, 012	Fort Steele	82J/2W	Coal	Sedimentary	47rdh, 12, 280 m
Fors (Citation Resources Inc.)	082GSW035	Fort Steele	82G/5W	Zn, Pb, Ag	Sedimentary Exhalative	2ddh, 1364 m; geophysics
Forty-nine Creek (McMahon Resources)	082FSW089, 090, 269	Nelson	82F/6W	Au, Cu, Ag	Vein	6ddh, ~1200 m
Greenhills (Fording Coal Ltd.)	082JSE007, 001, 005	Fort Steele	82J/2W	Coal	Sedimentary	97rdh, 16,400 m
Ice (Quest International Resource Corp.)	NA	Fort Steele	82J/2W	Diamonds	Magmatic	86 tonne bulk sample
Jersey / Emerald (Sultan Minerals)	082FSW009, 010, 011, 218	Nelson	82F/3E	Au, Pb, Zn Ag, W	Skarn, Sedimentary Exhalative	13 ddh, 1610 m; 3 u/g ddh, 90m; geochemistry; trenching
Kenville (Teck Corporation)	082FSW084, 085, 086	Nelson	82F/6W	Au, Ag, Cu	Vein, Porphyry	11ddh, 1941 m; geophysics

Property (Operator)	Minfile Number	Mining Division	NTS	Commodity	Deposit Type	Work Done
Lexington (Britannia Gold/Bren-Mar Resource)	082ESE041, 042	Greenwood	82E/2E	Cu, Au	Replacement, porphyry	700 m decline; u/g drilling; metallurgical testing
Line Creek (Line Creek Resources)	082GNE020, 021, 022	Fort Steele	82G/15 E, W	Coal	Sedimentary	6ddh, 2500 m
Midnight / IXL (Minefinders Corporation)	082FSW116, 119	Trail Creek	82F/4W	Au, Ag	Vein	7ddh, 861 m
Motherlode / Greyhound (YGC Resources)	082ESE034, 050	Greenwood	82E/2E	Au, Cu	Skarn	7ddh, 814 m; geochemistry; geophysical
Old Nick (Guy F. Atkinson Holdings/ Canadian Mine Services Ltd.)	082ESW055	Greenwood	82E/3E	Ni, Co	Magmatic	6ddh, 740 m; metallurgical testing
Rock Creek Gold Trend (Phoenix Gold / Orion International / Gold City Mining / First Point Capital)	082ESW022, 023	Greenwood	82E/3E	Au, Cu, barite	Skarn, Vein	2800 m diamond drilling; geophysics; geochemistry
Sullivan / Hope (Cominco Ltd.)	082FNE052	Fort Steele	82F/16E	Zn, Pb, Ag	Sedimentary Exhalative	1ddh, 671 m; surface and downhole geophysics
Summit Camp (Kettle River Resources)	082FSE064	Greenwood	82E/2E	Au	Vein, Skarn	14ddh, ~1100m; trenching; geochemistry; mapping
Upper Moyie (Sedex Mining Corp. / Kennecott Canada)	082FSE003, 115, 110	Fort Steele	82F/8E	Zn, Pb, Ag, Au, W	Sedimentary Exhalative, Vein	airborne and ground geophysics; geochemistry; mapping
White (Geo Resources)	082FSW086	Nelson	82F/6W	Au, Ag	Vein	6ddh, 929m

EXPLORATION HIGHLIGHTS

METALS

Purcell Anticlinorium

The most important exploration target from a regional perspective continues to be Sullivan-style sedimentary exhalative zinc-lead-silver mineralization in the Middle Proterozoic Aldridge Formation of the Purcell (Belt) Supergroup. These rocks occur in the core of a north-plunging anticlinorium located between the south end of Kootenay Lake and the Rocky Mountain Trench. Remaining reserves in the giant Sullivan orebody, a major contributor to the economy of the region and of the province for almost one hundred years, will be exhausted by the year 2001. Stimulated by the release in July, 1996, of initial results from a \$600 000, state-of-the-art, airborne geophysical survey, funded by the provincial government, exploration increased significantly in the Purcells in 1996, primarily at the "grassroots" level involving extensive mapping, prospecting and stratigraphic drilling. As a result of that activity, at least three areas, (upper Moyie River, Doctor Creek and the Yahk area) have provided sufficient encouragement to warrant advanced exploration in 1997.

The major participant in this renewed activity has been the joint venture of the Hastings Management Group of companies (mainly Sedex Mining Corp., and Abitibi Mining Corp.), with Kennecott Canada Inc. Each of the two participants financed 1/2 of a \$1 million budget. The joint venture explored holdings of over 2000 claim units scattered among several properties in the Purcells and completed two of their own airborne magnetic surveys and a surface gravity survey to compliment the data obtained from the government survey. Several preliminary drill tests were carried out in selected areas, mainly to map stratigraphy and alteration. Targets for the joint venture include gold mineralization and other deposit types in addition to the main Sullivan-type target. They have identified several very promising areas, particularly in the upper Moyie River and east of Yahk, and are expected to return in 1997 with another aggressive program including larger, more focused drilling programs on several properties.

The 50/50 joint venture of Miner River Resources Ltd. and Eagle Plains Resources Ltd. explored a large block of claims stretching from Findlay Creek to Skookumchuk Creek northwest of Kimberley. The area is underlain by rocks of the Aldridge Formation, is traversed by the Lower-Middle Aldridge contact (the stratigraphic position of the Sullivan

orebody), and has long been considered highly prospective for a Sullivan-type deposit. The joint venture completed detailed mapping and prospecting over most of the area and drilled about 900 metres, mainly in the Rusty Ridge and upper Doctor Creek areas. At the headwaters of one branch of Doctor Creek, a tabular body of tourmalinized siltstone, highly anomalous in lead and arsenic, was discovered and traced for at least 800 metres. An initial drill test has shown it to be at least 21 metres thick. Although situated high in Middle Aldridge strata, it signals the presence of strong Sullivan-type hydrothermal activity and metal enrichment. A letter of agreement has been signed with Kennecott Canada Inc. which would see the major company spend \$2 million on the property over 4 years.

On Mark Creek, northwest of the Sullivan mine, Cominco Ltd. completed the drilling of a long, vertical hole to further test a fault-displaced segment of the Sullivan deposit. The hole reached its target depth and was stopped at 2608 metres below surface. Downhole geophysics followed completion of the hole and Cominco is currently assessing the data.

Quest International Resource Corporation drilled approximately 4000 metres in 8 holes to investigate anomalous base metals in soils on its Del claims at the head of Dodge Creek, southwest of Creston. The claims cover an old showing known as Dodge and characterized by abundant tourmalinite float and weak, stratabound lead-zinc mineralization in metamorphosed Middle Aldridge wackes and siltstones. The occurrence has been interpreted as an inverted tourmalinized hydrothermal vent. Results of the drilling have not been reported.

At the Fors property on the west side of Moyie lake, Citation Resource Inc. is drilling deep holes to test the Sullivan horizon in a hypothesized synsedimentary graben structure. Earlier in the year, Quest International terminated its option on the property with the owners, Chapleau Resources Ltd. and Barkhor Resources Inc., who then optioned it to Citation. At year end, 1364 metres of drilling had been completed out of a planned total of about 2600 metres.

At the former Bull River mine, on the east margin of the Rocky Mountain Trench, east of Cranbrook, R.H. Stanfield and Assoc. has commenced excavation of a 1500-metre decline to provide access for underground drilling and bulk sampling. Copper-gold mineralization occurs in quartz-carbonate veins cutting Aldridge Formation siliciclastics and was previously mined from two small open pits. Deep drilling by the present owners over several years has indicated a substantial underground resource which will

be more easily evaluated following completion of the decline.

Further north in the Purcell Mountains, on Vowell Creek south of Golden, Mountain Star Resources conducted a modest program of underground drilling expected to increase remaining reserves at the former-producing Ruth Vermont silver-lead-zinc mine. Mineralization occurs in veins hosted by Late Proterozoic Horsethief Creek sedimentary rocks. The company has not announced results of the work or commented on future plans.

Other Metal Projects

At the Jersey-Emerald project south of Salmo, where Sultan Minerals Inc. is evaluating the gold potential of a large property which includes both the former Jersey lead-zinc-silver mine and the former Emerald tungsten mine, Prior to the 1996 program, the company had identified three zones of primary interest on the property, the Bismuth and Emerald-Leroy gold zones and a 2.5 sq.km. copper-zinc-silver soil anomaly on Iron Mountain east of the former mines. After completing a total of 1700 metres of diamond drilling in 16 holes, including 3 short underground holes in the Bismuth gold zone, the company has received significant encouragement about potential of all three zones but has also identified a previously unrecognized zinc and lead enriched dolomite horizon, with major size and grade potential, beneath the former Jersey mine workings. The presence of the lower mineralized zone has been confirmed by four 1996 holes and by re-interpretation of two 1973 holes drilled by Placer Dome prior to closure of the Jersey mine. Tentative correlation with mineral showings up to 2.5 kilometres south of the mine suggests that this new "Lower Jersey" horizon may have major lateral extent. The Bismuth gold zone, exposed in the Jersey mine underground workings, is a flat-lying silicified zone characterized by massive pyrrhotite and arsenopyrite with stibnite and native bismuth. It overlies and is parallel to the east limb of the original Jersey orebody and has assayed up to 12 g/t Au in chip samples. The zone is consistently about 9 metres thick where intersected by drilling and is tentatively interpreted to extend over a north-south distance of 1000 metres. An aggressive program of underground drilling to test both the Bismuth and Lower Jersey zones is planned for early 1997.

Teck Corporation completed eleven diamond drill holes totalling 1941 metres on the Kenville Mine property, which is located about 8 kilometres west of Nelson and comprises claims optioned from Anglo Swiss Industries Ltd. and from prospector Eric Denny. Most of the drilling was designed to test a large and

strong IP chargeability anomaly south of the former Kenville gold mine workings. The target mineralization is porphyry-style copper-gold in pervasively altered diorite. Detailed results of the drilling have not been released but they are described as encouraging with four different styles of mineralization encountered, including additional gold-silver bearing quartz veins parallel to and similar to those mined at the Kenville mine. Moderate-sized drill programs were conducted on two properties adjoining the Kenville property with the same targets, porphyry-style copper-gold and shear-hosted, gold-bearing quartz veins. At Fortynine Creek, McMahon Resources Ltd. drilled approximately 1200 metres in 6 holes. Assays are incomplete but early reports are of anomalous gold in wide shears and silicified breccia zones. On the White crown grant, which is actually part of the original Kenville mine property, Geo Resources Ltd. and Global Focus Resources Ltd. drilled 6 holes totalling 929 metres. Results have not been reported.

At the Midnight-IXL property on the southwest edge of the Rosslund gold camp, Minefinders Corporation completed 7 surface diamond drill holes late in the year. The objective is to develop new reserves in the former IXL and Midnight mines where gold-rich veins are developed in a serpentinized regional thrust fault. Gold grades in both mines are known to significantly exceed the average grade for most other former producers in the Rosslund camp. The program was cut short due to heavy snow in December and is expected to resume in the spring.

At Eholt, north of Grand Forks, Teck Corporation completed a two-phase program of diamond drilling on a skarn-hosted copper-gold prospect which combines its Bear-Cub claim group with a large, contiguous claim block optioned from Orvana Minerals Corp. Drilling by Orvana in 1995 identified a structurally controlled zone of skarn alteration, known as the Dead Honda Zone, which contains moderate-grade but very continuous gold-copper values. The zone trends north to northeast and has now been shown to extend onto the Bear-Cub claims. A total of about 1930 metres in 12 holes, six on each claim group, were drilled. No detailed results have been released. However, mineralized skarn is reported from some of the holes and the Dead Honda Zone is considered to remain open along strike, both north and south.

Also near Eholt and south of Wilgress Lake, Kettle River Resources Ltd. excavated several trenches and drilled fourteen holes to investigate gold-bearing silicified zones on the Pac claims ("Summit Camp Property"). Initial surface grab samples and panel samples from shallow trenches are reported to have yielded some very high gold grades, up to 85 g/t Au.

Drilling has so far not succeeded in tracing the high values to depth. The gold is reported to be associated with conformable veins and lenticular zones of silicification in a north-striking, vertical, well-bedded Triassic limestone.

Elsewhere in the Greenwood camp, YGC Resources completed 814 metres of diamond drilling in seven holes on a property which includes the former Motherlode and Greyhound skarn-hosted, open-pit, copper-gold mines immediately northwest of the community of Greenwood. At the Lexington copper-gold prospect south of Greenwood and adjacent to the US border, Britannia Gold Corporation and Bren-Mar Resources Ltd. completed a 750-metre decline to access the Grenoble zone. While awaiting permits needed to commence mining of the zone, the operators undertook metallurgical testing of a 200 tonne bulk sample collected near the portal and did some underground drilling from the base of the decline to better define the 145 000 tonne inferred reserve grading 1.06% Cu and 6.5 g/t Au calculated from surface drilling.

West of Rock Creek, the joint venture of Phoenix Gold Resources Ltd., Orion International Minerals Corp. and Gold City Mining Corp. further explored its extensive belt of contiguous properties known as the "Rock Creek Gold Trend", extending northwesterly from the US border through the former Dayton and Camp McKinney gold camps. They completed several geophysical surveys and a total of 2800 metres of core drilling. Most of the drilling was conducted on the Ket 28 claim just north of the border where a drill intersection grading 44.6 g/t Au over 3.35 metres was obtained in 1994. The steeply-dipping zone of massive silicification is reported to be traceable over a strike length of 300 metres and a width of 50 metres. Later in the year, First Point Capital Corporation obtained an option to earn 50% of the joint venture by spending \$1.9 million over 6 years

Within the Gold Trend, the same joint venture had optioned its Old Nick nickel-cobalt prospect, located just southeast of Bridesville, to Guy F. Atkinson Holdings Ltd. which drilled six NQ holes totalling 740 metres to obtain representative material from the Main zone for metallurgical testing. Canadian Mine Services Ltd. and Monument Mining Corp. then assumed responsibility for operation of the project under a new option agreement and is proceeding with the metallurgical testing. It was recently announced that a \$750,000 program has been budgetted for 1997. Previous exploration of this old prospect led to an estimate of about 30 million tonnes of material grading 0.22% Ni and 0.015% Co and accessible to surface mining. The metal values are disseminated within a

peridotite intrusive body and in adjacent altered quartzite.

A four hole, 1625 metre drill program was completed by Diamet Minerals Ltd. at its claim group on Albert River east of Invermere in the Rocky Mountains. Previous work had uncovered coarse calcite vein-breccia containing scheelite and minor base metals associated with extensive anomalous tungsten and gold in soils. The drilling was intended to confirm the existence of a buried alkaline intrusive, interpreted from geophysics, and to locate skarn-hosted gold-tungsten mineralization predicted to be associated with the intrusive. Results of the program, which was terminated early due to heavy snow, have not yet been reported.

INDUSTRIAL MINERALS

Just north of Elkford, on the west side of the Elk Valley, Quest International Resources Corp. collected a total of 86 tonnes of kimberlite from 3 pipes discovered in 1994 on its Ice property. At that time, two fragments of gem-quality diamonds were found in decomposed kimberlite from surface exposures of two of the pipes. During road construction prior to sampling, the amount of kimberlite present in the vicinity of the sample sites was found to be much more extensive than previously assumed. The samples were sent to Colorado to be tested for diamond content.

I.M.P. Industrial Mineral Park Mining Corp. has collected a few thousand tonnes of graphite-bearing, decomposed marble from its Black Crystal graphite prospect on Hoder Creek west of the Slocan Lake. The sample was transported to the company's nearly-completed pilot mill on Koch Creek in the Slocan Valley. When the mill is finally operating, this sample material, together with the 4 or 5 thousand tonnes stockpiled in 1995 will be tested for recovery and quality of the contained flake graphite. Early snow cover in mid-October prevented full recovery of the approved 10 000 tonne bulk sample and forced postponement of a 30-hole diamond drill program.

At the small community of Brisco north of Radium Hot Springs, calcium carbonate water, emerging from cold springs beneath a small lake, has developed an extensive surface blanket of tufa, at least seven metres thick in places, which extends across several fields on both sides of Highway 95. The owners of some of the affected land, the Wolfenden family, have staked the tufa deposit and are already marketing it profitably to alpine gardeners in Calgary. The tufa is of good quality and easy to extract in large chunks with a backhoe. The owners plan to explore the deposit in 1997 by drilling to measure its full extent.

A new sodalite discovery at Mather Mountain on the Blaeberry River north of Golden was explored by prospector David Lefurgey, with financial support from the BC government in the form of an Explore BC prospector grant. The sodalite occurs in a lenticular zone of brecciated Cambrian limestone in the bottom of a steep creek gully. The zone measures about 3 metres by 1 metre where exposed and contains an estimated average of 35% by volume of deep blue sodalite, mainly filling interstices between carbonate fragments. In addition to the main zone, there is another smaller zone and numerous large boulders of the same material in the vicinity. The brecciation is associated with a fracture zone in the centre-line of the creek, suggesting that there is a good chance for discovery of more sodalite on the claims. Approximately 4 tonnes of material were removed from the site for testing.

R.H. Stanfield and Associates are testing the potential of a Cretaceous granitic intrusion as a source of marketable feldspar on the Aspen property southwest of their Bull River copper-gold mine near Cranbrook.

Feldspar is present in the intrusion as very coarse phenocrysts. About 1000 metres of

rotary drilling was completed in December.

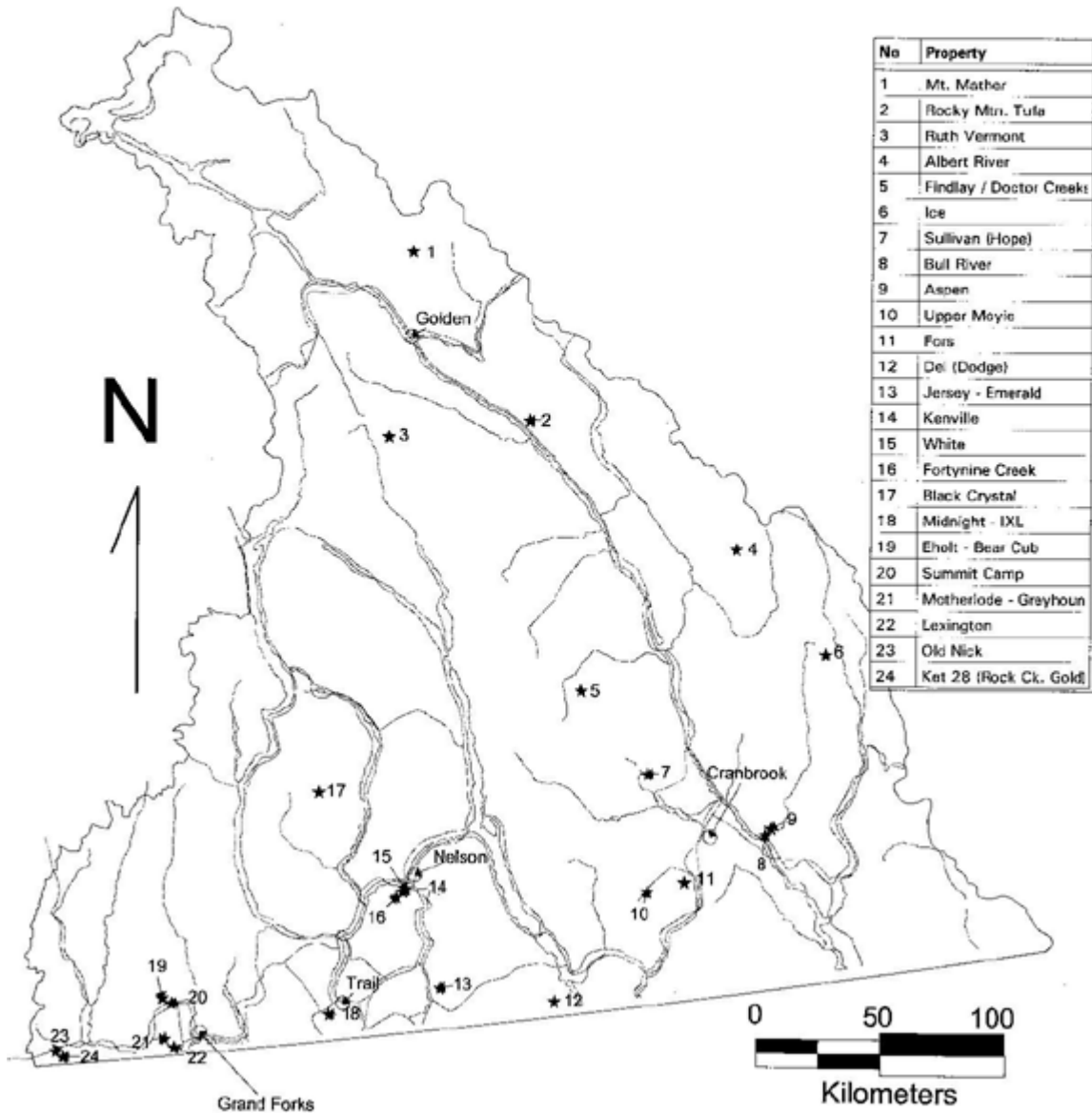
ACKNOWLEDGEMENTS

Thanks are due to the many industry managers, geologists and field staff who were willing to share their data with the author and to provide access to their exploration properties. Without their cooperation, compilations and reviews of this type would not be possible. Early submission of Notices of Completion to the District Manager in many cases also assisted in the gathering of important statistics when direct contact with field staff was not achieved.

The author also gratefully acknowledges the assistance of his colleagues, in particular Gordon MacKay who prepared the histograms, map and table, and Derek Brown for his skilled editing of a preliminary draft.

Kootenay Region

Key Exploration Projects - 1996



EXPLORATION AND DEVELOPMENT HIGHLIGHTS SOUTHWESTERN BRITISH COLUMBIA - 1996

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INTRODUCTION

The Ministry of Employment and Investment, Regional Operations, Health and Safety Branch adjusted its boundaries in the spring of 1996 and transferred responsibility for regional geology in the Queen Charlotte Islands to the Northwestern Regional Office, in Smithers. The Southwestern Regional Geology office in Vancouver is responsible for monitoring exploration and other geoscience activity on Vancouver and the Off-shore Islands and in the Coast Mountains southeast of Bella Coola (Figure 1). It also handles land-use issues on the Lower Mainland.

HIGHLIGHTS

- Quinsam Coal Corporation reached its long-standing target production-rate of 1.2 million tonnes of clean coal per year at the Quinsam mine, near Campbell River.
- Quinsam Coal Corporation defined a 30 million tonne coal reserve in the T'Sable River area, near Courtenay.
- Athabaska Resources Limited significantly increased reserves at the Ladner Creek (Carolin mine) gold deposit, northeast of Hope.
- Imperial Metals Corporation ran a major exploration program over the Invermay zone on the Giant Copper copper-gold property, southeast of Hope.
- Government completed protected area selection on Vancouver Island and the Lower Mainland.

EXPLORATION TRENDS

Metal production in the region dropped in 1996 following closure of the Island Copper mine near Port Hardy, at the end of 1995. There is now only one producing metal mine in the region, the Myra Falls Operation near Campbell River. Coal production increased substantially from the one producing coal mine at Quinsam Lake, also near Campbell River. Industrial mineral and aggregate production, most of which comes from several large industrial mineral quarries and sand and gravel operations on Texada Island on Vancouver Island and in the Lower Mainland, remained relatively stable. Most of the currently producing operations in the region have invested

heavily in exploration and development over the past few years and have reserves to continue production for many years to come.

Exploration activity in the region increased in 1996. Results were, for the most part, positive. Companies working on advanced properties, such as Ladner Creek and T'Sable River, added to their reserves and companies working on relatively unknown properties, such as Knob Hill and Lucky, made new discoveries. Several of the more advanced projects could go through feasibility and into production over the next few years.

The total investment in exploration in the region in 1996 is estimated at \$8.5 million; far higher than the \$6.0 and \$5.0 million dollar estimates made for the previous two years. In fact, the figures are not even strictly comparable now that the Queen Charlotte Islands have been dropped from the region. If expenditures there were added to the total for Vancouver Island and the Southern Coast Mountains the total would be nearer \$14.5 million, more than double the previous two years.

Most of the expenditures were made on relatively few high-profile projects, at past and present producing mines and on advanced exploration properties. However, the bias in favour of advanced exploration was less pronounced than in recent years. Five projects, those at Ladner Creek, Myra Falls, T'Sable River, Giant Copper and Dragon account for approximately \$5.5 million of the aggregate expenditure. Sixteen smaller projects make up the bulk of the remainder.

The number of major projects in the region (arbitrarily defined as those likely to have incurred costs in excess of \$100 000) increased sharply from twelve (including one in the Queen Charlotte Islands) in 1995, to twenty one in 1996. The increase is encouraging. However, the number is still small when compared with figures reported in the late 1980s. The apparent lack of sustained interest in early-stage exploration is a concern given the declining reserve base in the province.

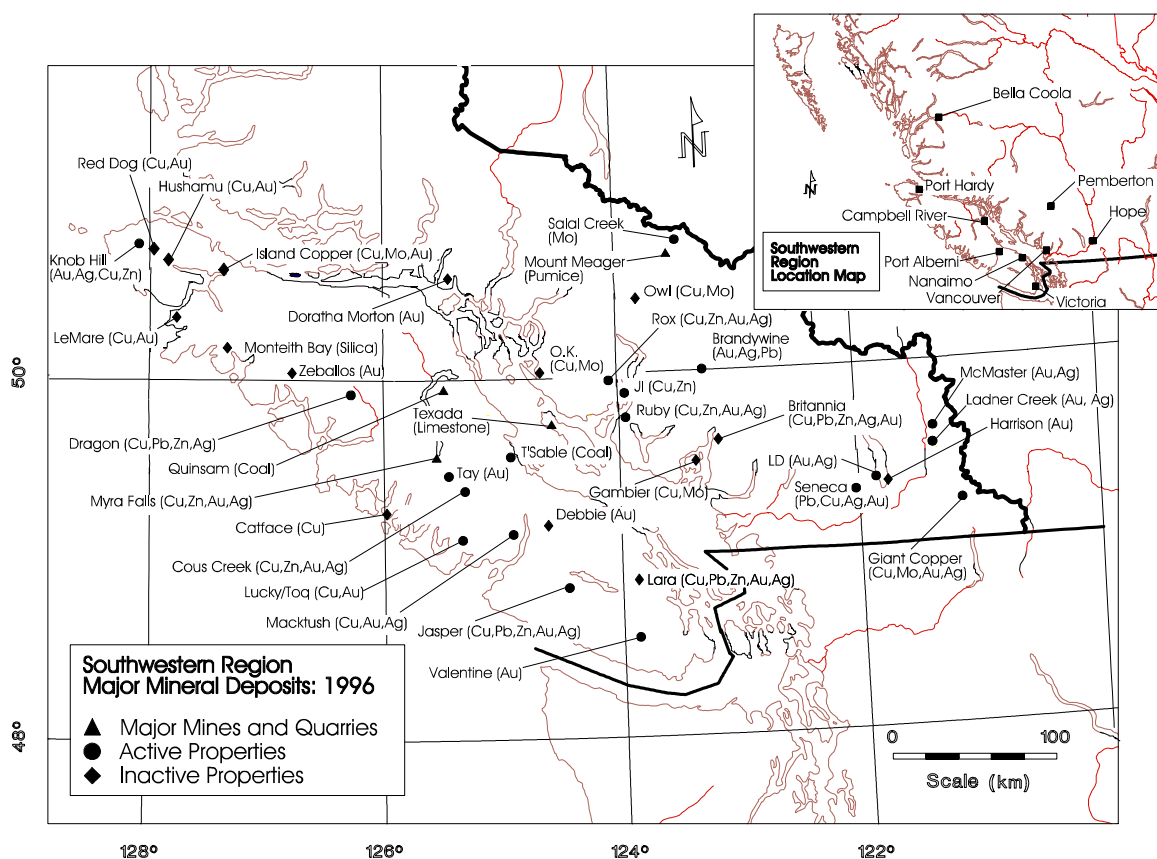


Figure 1. Location Map

TABLE 1. MAJOR EXPLORATION PROJECTS SOUTHWEST REGION

Property (Owner)	MINFILE Number	Mining Division	NTS	Commodity	Deposit Type	Work Done
Brandywine (La Rock Mining Corp.)	092JW001	Vancouver	92J/3E	Au,Ag,Pb	Shear/vein	13 ddh, 1436m
Cous Creek (Ashworth Explorations Ltd.)	092F 360	Alberni	92F/2W	Cu,Zn,Au,Ag	Shear/vein	geophys; trenching
Dragon (Westmin Resources Ltd.)	none	Alberni	92E/15W	Cu,Pb,Zn,Ag, Au	Massive sulphide	geol; geochem; 4 ddh, 1300 m
Giant Copper/Invermay (Imperial Metals Corp.)	092HSW002	New West.	92H/3W	Cu,Mo,Au,Ag	Porphyry breccia	airborne geophys; geol; geochem; 16 ddh, 2835 m
Jasper (Inspiration Mining Corp.)	092C 080	Victoria	92C/15E	Cu,Pb,Zn,Au, Ag	Massive sulphide	geol; geophys; geochem
JI (Aquaterra Mineral Development)	none	Vancouver	92G/13W	Cu,Pb,Zn	Massive sulphide	2 ddh, 832 m

Property (Owner)	MINFILE Number	Mining Division	NTS	Commodity	Deposit Type	Work Done
Knob Hill (First Choice Industries)	102I 005	Nanaimo	102I/16E	Au,Ag,Cu,Zn	Transition/ Porphyry	geol; geophys; geochem; 10 ddh, 600 m
Ladner Creek (Athabaska Gold Corp.)	092HNW007	New West.	92H/11W	Au,Ag	Vein	56 u/g ddh, 6390 m; trenching
LD (Flame Petro- Minerals Corp.)	092HSW070	New West.	92H/5W	Au,Ag	Vein	7 ddh, 823 m
Lucky/Toq (Consolidated Logan Mines Ltd.)	none	Alberni	92F/3W	Cu,Au	Vein	airborne geophys; geol; geochem
Macktush (SYMC Resources Ltd.)	092F 012	Alberni	92F/2W	Cu,Au,Ag	Vein	trenching
McMaster (Athabaska Gold Corp.)	092HNW018	New West.	92H/11W	Au,Ag	Vein	9 ddh, 1057 m
Myra Falls (Westmin Resources Ltd.)	092F 330 092F 073	Alberni	92F/12E	Cu,Zn,Au,Ag	Massive sulphide	4 u/g ddh, 2300 m
Quinsam Coal (Quinsam Coal Corp.)	092F 319	Nanaimo	92F/13E 92F/14W	Coal		16 pdh, 2198 m
Rox (Navarre Resources Ltd.)	092K 083	Vancouver	92K/1E	Cu,Zn,Au,Ag	Vein	8 ddh, 547 m
Ruby (Menika Resources Ltd.)	092GNW050	Vancouver	92G/12W	Cu,Zn,Au,Ag	Vein	geophys; 4 ddh, 725 m
Salal Creek (Verdestone Gold Corp.)	092JW005	Lillooet	92J/14W	Mo	Porphyry	2 ddh, 489 m
Seneca/Fleetwood (International Curator Resources Ltd.)	092HSW165	New West.	92H/5W	Zn,Cu,Ag,Au	Massive sulphide	geol; geochem; geophys
Tay Gold (Dalmation Resources Ltd.)	092F 212	Alberni	92F/6W	Au	Shear/vein	airborne geophys
T'Sable River Coal (Quinsam Coal Corp.)	none	Nanaimo	92F/10W	Coal		27 pdh, 6543 m
Valentine Mountain (Beau Pre Explorations Ltd.)	092B 108	Victoria	92B/12W	Au	Vein	bulk sample

The number of major projects in the region (arbitrarily defined as those likely to have incurred costs in excess of \$100 000) increased sharply from twelve (including one in the Queen Charlotte Islands) in 1995, to twenty one in 1996. The increase is encouraging. However, the number is still small when compared with figures reported in the late 1980s. The apparent lack of sustained interest in early-stage exploration is a concern given the declining reserve base in the province.

The major projects (Figure 1; Table 1) covered a variety of commodities and deposit types. There were nineteen metallic mineral projects, including five that were directed at the discovery of volcanogenic massive sulphide deposits, three directed at porphyry copper and/or molybdenum targets, and eleven directed at precious metal-bearing vein systems. There were also two coal projects.

There were no major industrial mineral projects in the region in 1996. But there were a number of developments that should strengthen the industrial mineral sector in the years to come. On Vancouver Island, for instance, MacMillan Bloedel Ltd's Nexgen high-grade paper production facility at Port Alberni will come on stream in 1997. It will make light weight coated paper with 30% mineral content. This, and other similar moves towards production of refined paper, bodes well for the production and consumption of industrial mineral fillers. Elsewhere on Vancouver Island, Quinsam Coal Corporation's recent expansion of the Quinsam coal mine has increased demand for magnetite, some of which could be supplied from within the region.

Similarly, on the Mainland, Lafarge Canada's proposal to double production of Portland Cement at its plant in Richmond (to over 1.0 million tonnes) has gone through the Environmental Assessment Process and been recommended for certification. The expansion will increase demand for limestone from Texada Island, silica and clay from Sumas, and coal from the Quinsam mine. Elsewhere, in Squamish Garibaldi Granite Limited and Pender Capital Corporation have opened a rock processing plant that produces rough-sided cut-blocks for walling. The operation fills a niche in the growing dimension stone market in the Lower Mainland and northwestern United States.

OPERATING MINES AND QUARRIES

Most of the mines and major quarries in the region had a successful year and either maintained or increased production. Westmin Resource's Myra Falls Operation was no exception but it was affected by temporarily increased production costs associated with the development of the Battle zone and it was hurt by

the sharp drop in copper price that followed Sumitomo's problems in the copper market.

MYRA FALLS OPERATION

Westmin Resources Limited operates a nominal 4000 tonnes per day underground mining operation, employing approximately 400 people at Myra Falls, at the south end of Buttle Lake on Vancouver Island. It mines a large and complex volcanogenic massive sulphide deposit comprised of numerous discrete lenses. In 1996 it produced 16.91 million kilograms of copper, 37.06 million kilograms of zinc, 687 419 grams of gold and 11.89 million grams of silver from 1.27 million tonnes of ore grading 1.58% Cu, 3.93% Zn, 0.13% Pb, 1.73 g/t Au and 21.94 g/t Ag.

Westmin's Myra Falls Operation has been in transition over the past few years as the company has worked to reduce operating costs and increase the value of the concentrate it produces. In 1996, it made headway on both accounts. Most notably, zinc head-grade rose by 45% as the company increased production from the recently discovered and delineated Battle zone and its high-grade satellite known as the Gopher zone.

As of December, 1996, the operation had an aggregate mineable reserve of 9 098 407 tonnes grading 1.5% Cu, 6.6% Zn, 1.4 g/t Au and 28.6 g/t Ag, which is more ore at a higher grade than at any time in its 27 year history. Westmin's underground exploration programs have proved to be exceedingly cost effective. It estimates that, since 1980, the direct exploration cost associated with finding a tonne of ore has been little more than \$1.0. The company feels that it currently has two very attractive exploration targets (Marshall and Trumpeter zones) to pursue for additional reserves and it is confident that it will find still more zones through careful exploration. It continues to refine its understanding of the geology of the deposit and to work on interpreting the controls on mineralization and the significance of fault off-sets.

In 1996, Westmin focused much of its development effort in extending the 24 level rail haulage drift out from the H-W shaft to the south end of the Gopher and Battle zones, a distance of approximately 1.8 kilometres. It also developed the ore passes required for large-scale production of high-grade ore from these relatively zinc-rich lenses. By year's end, it was producing through the haulage way, relieving the congestion caused by batch mining the Gopher zone through the 18 level exploration drift. The company currently blends ore from the Gopher (11.4% Zn, 1.8% Cu) and Battle (8.6% Zn, 1.7% Cu) zones with material from the long-established H-W zone (3.2% Zn, 1.5% Cu). The amount of ore produced from

the Gopher and Battle zones should rise in 1997 and zinc production should increase substantially. Copper production, on the other hand, is likely to remain fairly stable and there will be a slight drop in the amount of precious metal recovered.

Westmin continued definition drilling of the Battle zone in 1996, but delayed further drilling of the new zones at Trumpeter and Marshall until it had improved access to them and developed suitable underground drill stations. Over the summer, it drove a 300 metre cross-cut on the 13 level in the Price mine west of Thelwood Creek, and established stations for drilling the Trumpeter zone. The company has since started a systematic drill program to evaluate the north western extension of the Trumpeter zone under the ridge that separates Thelwood from Myra Creek. The program will likely extend well into 1997.

Westmin had hoped to drill some deep holes from surface on the upper slopes of Phillips Ridge, in the northwestern part of their land holdings. It planned to use the holes to test the stratigraphy in the vicinity of the Marshall zone and in a hitherto untested area between the western limit of the known mineralization and the Strathcona Park boundary. Unfortunately, the program had to be deferred because of a combination of adverse snow conditions in the spring and permitting delays over the summer. The program may go ahead in 1997.

Elsewhere, in the Lynx mine area the company drilled a fence of four underground exploration holes, for an aggregate depth of 2300 metres, to test for H-W "mine series" stratigraphy in a previously unexplored area at depth below and to the south of the known Battle orebodies. Although none of the holes intersected massive sulphide, the company considers the results to be encouraging. The two northernmost holes intersected thick sections of altered rhyolite overlying sediment, suggesting that there may be favourable conditions for mineralization along strike.

QUINSAM COAL MINE

Quinsam Coal Corporation operates an underground coal mine near Campbell River on Vancouver Island. In 1996, it employed approximately 222 people and produced 902 639 tonnes of clean thermal coal for use in local cement plants and off-shore, coal-fired, electrical generating plants.

The operation has seen considerable change over the past few years. It has moved from being a relatively small, 250 000 tonnes/year, open-pit producer to being a far larger, 1 200 000 tonnes/year, underground operation that uses a combination of

"continuous miners" and conveyor systems to mine by room and pillar methods. The company completed its expansion program in the summer of 1996. It called for considerable additional mine development, construction of a second wash plant and enlargement of its load-out facilities near Campbell River. The mine is now in a period of consolidation as it continues to develop the underground infrastructure required to maintain the higher level of production. It is currently working with five "continuous miners" and plans to add a sixth as a back-up.

The Quinsam operation is located in the Comox Coalfield and it exploits coal seams developed in coastal, non-marine, lagoonal sediments stratigraphically above a basal conglomerate that sits on an eroded basement. There are four main seams, or zones, in the basin (referred to as No.'s 1 to 4, numbered from bottom of the section upward) separated by intermixed mudstones, siltstones and sandstones. The coal seams tend to thicken in the deeper parts of basins and thin toward palaeo-topographic highs. The sediments are tilted and the seams commonly display a shallow dip to the east or northeast. They are faulted and, locally, show considerable dislocation and off-set.

Quinsam Coal Corporation has defined several fault-bounded structural blocks at Quinsam, based on structural integrity and the presence of a mineable thickness of coal. There is one main block (2N/3N) north of the Quinsam River and east of Middle Quinsam Lake. There are two to the south of the river (5S/6S, 7S/Lot242) and a further two south of Long Lake (1S/2S/3S, 4S).

Most of the production in 1996 came from the bottom, or No. 1, seam at Quinsam. It came from the large and well developed 2N block and the smaller 2S block, at least until the latter reached the end of its productive life in the fall. The remainder came from the No. 3 seam which started to contribute as the 4S and Lot 242 blocks started to produce later in the year. Over the next few years, the company will blend coal from the two seams.

The 4S block contains coal from the No. 3 Seam. It is discontinuous and shaley at surface near the portal and to the northwest, but thickens dramatically down-dip, to the south and east. Much of the current in situ, drill indicated, proven and probable reserve of 5.5 million tonnes is based on a seam with a mineable unit thickness of 2.4 metres. The coal is relatively enriched in sulphur, averaging around 3.0% sulphur.

The Lot 242 development, on the north side of the Iron River, also exploits coal from the No. 3 seam. However, it includes elements of the No. 4 seam where the two merge. The block is structurally off-set from 4S

and the coal is generally similar, however, it has a considerably lower (1.0%) average sulphur content. It has an in situ, drill indicated, proven and probable reserve of 3.5 million tonnes.

Over the summer, Quinsam Coal carried out a rotary drill program that included core recovery of the coal seams and down-hole geophysical surveys. The company drilled 10 holes for an aggregate total of 1647 metres down dip from the main No. 1 heading in the 2N area and increased the proven and probable reserve by 800 000 tonnes. It also drilled 6 holes for an aggregate total of 551.5 metres in the 4S area to confirm continuity and delineate faults in advance of driving the main production heading.

ISLAND COPPER

BHP Minerals (Canada) Limited closed the Island Copper mine, near Port Hardy, at the end of December, 1995, bringing to an end twenty five years of operation that created 16 250 person years of employment and produced 1.3 billion kilograms of copper, 31 million kilograms of molybdenum, 31.7 million grams of gold, 336 million grams of silver and 27 000 kilograms of rhenium from 399.4 million tonnes of ore grading 0.4% Cu and 0.017% Mo.

The company started work on its site reclamation plan several years ago and continued to implement the program in 1996. It has contoured and revegetated the land dumps, groomed the beach dump and flooded the pit with seawater. It has also routed run-off water into the pit where it will form a freshwater cap over what will eventually become a meromitic lake. It will monitor environmental conditions for several years to come. The company is still disposing of its physical assets at the mine, including the mill and concentrator circuits and the deep water load-out facility.

LIMESTONE QUARRIES

Holnam West Materials Limited and Ash Grove Cement Company are the major suppliers of limestone in the Pacific Northwest. They employ approximately 150 people and ship approximately 5.0 million tonnes of product per year, roughly 85 % of total provincial production.

In 1996, Holnam West produced approximately 2.2 million tonnes of cement grade limestone from its Gillies Bay quarry, at the north end of Texada Island. The product was sold to the Tilbury and Lafarge cement plants in the Lower Mainland and to Holnam's affiliate in the Seattle area of Washington State. The company also produced 0.25 million tonnes of chemical grade material and approximately 0.55

million tonnes of mixed product, including white limestone, agricultural grade limestone, rip-rap and crushed aggregate that is used in the construction industry. Over the past two years, the company has supplied over 1.0 million tonnes of limestone for the building of the new container port at Robert's Bank.

Quinsam Coal Corporation uses Holnam West's load-out facilities on Texada Island for the transshipment of coal from the Quinsam mine to ocean going freighters. The amount of coal going through the load-out facility has increased significantly over the past few years.

Similarly, Ash Grove Cement produced 1.2 million tonnes chemical and cement-grade limestone from its quarry at Blubber Bay, at the north end of Texada Island. Most of it was sold to affiliate companies operating in the United States. It also produced approximately 0.8 million tonnes of agricultural and aggregate grade material for use in the Lower Mainland. The aggregate component included a sizable contract to supply material for the recent expansion of Vancouver International Airport.

There are two other limestone quarries on Texada Island. One is owned by Imperial Limestone Company and the other by Lafarge Canada Inc.. Neither has been particularly active in recent years. However, that may change. Lafarge plans to up-grade its cement plant, in Richmond, and double its Portland Cement production to approximately 1.0 million tonnes per year. This will increase demand for cement grade limestone. The company has not yet announced whether it will reopen its own quarry or continue to purchase limestone from other suppliers.

Imasco Minerals Inc. owns a small limestone operation near Benson Lake on Vancouver Island. It produces bright, white, recrystallized limestone for specialty markets such as chips for stucco and filler material for paint and putty. In 1996, it increased production from 41 000 tonnes to 50 000 tonnes per year.

MINE DEVELOPMENT SUBMISSIONS

There were no new mine development submissions in 1996. The two most recent applicants have received their mine development certificates. Monteith Bay Resources Limited is waiting for market conditions to improve before opening its "geyserite" (silica) deposit on Easy Inlet on the west side of Vancouver Island. Great Pacific Pumice has started relatively small-scale production from its quarry on the north flank of Mount Meager north of Pemberton. It shipped approximately 30 000 cubic metres of pumice

to horticultural suppliers and plant nurseries in the Lower Mainland.

EXPLORATION ACTIVITY

VANCOUVER AND TEXADA ISLANDS

There were relatively few major exploration programs on Vancouver Island in 1996. However, they produced positive results and there is likely to be more activity in the area in 1997. The amount of grass-roots and very early-stage exploration that took place is hard to quantify but it appears to be well down from what was considered to be the norm a few years ago.

KNOB HILL

There was only one major exploration program at the north end of Vancouver Island. First Choice Industries Limited explored for porphyry-copper and related transitional to epithermal mineralization in Bonanza volcanic rocks at Knob Hill, near Holberg, at the northwest end of the Island Copper - Hushamu porphyry belt.

First Choice staked the property to cover a broad, weak, soil (copper, zinc and molybdenum) geochemical anomaly that was found by Chevron Standard shortly after the discovery of the porphyry deposit at Island Copper. The company ran a preliminary grid survey over the area in 1995, and identified a gold, arsenic, lead and zinc soil geochemical anomaly on the outer fringe of Chevron's main area of interest. In 1996, First Choice focused its attention on the precious metal potential of the area. It expanded the grid, extended the soil geochemical survey and mapped what little outcrop was available. In so doing, it discovered that the gold soil geochemical anomaly is broadly coincident with a magnetic low that is, at minimum, 1.5 km long and 1.0 km wide and, in part, underlain by an intensely altered and mineralized rhyolite flow-dome complex.

In the fall, the company used a small, portable drill-rig to explore part of the combined geophysical and geochemical anomaly. It drilled ten short diamond drill holes for an aggregate depth of 600 metres. Nine holes intersected intensely mineralized siliceous and clay altered massive rhyolite and rhyolite breccia. The massive rhyolite is fractured, crackle-brecciated and cut by irregular, fine-grained, polymetallic sulphide veins and replacements. The veins contain abundant fine-grained, sooty pyrite and arsenopyrite and minor amounts of chalcopyrite, sphalerite and galena. The breccias are polymictic. They contain abundant fragments of sulphide-veined rhyolite and less frequent

fragments of discrete sulphide veins and of chalcopyrite-bearing andesite. The company feels that the tenth hole may have intersected a dike. It encountered pyrite, epidote and carbonate veined andesite.

The sulphide vein system is auriferous. Gold values range from a few tens or hundreds of parts per billion over substantial lengths of highly altered mineralized rhyolite, to erratic high values of several tens of parts per million over a few centimetres in selected sulphide veins.

After completing its drill program, First Choice Industries conducted an induced polarization geophysical survey over the grid. The results showed that it had drilled part of a large high-chargeability zone that extends for a considerable distance to the northwest and wraps around the north end of a high resistivity zone that seems to correlate with Chevron's original soil geochemical anomaly.

The results to date show that the Knob Hill property covers a large, high-level, high-sulphidation mineral system. The company expects to be back for a second drill program in 1997. It will drill the high-sulphidation zone looking for high-grade gold veins and the copper-rich high-resistivity zone for porphyry-type mineralization.

DRAGON

Further south, Westmin Resources Limited explored for volcanogenic massive sulphide deposits in a highly prospective fault and intrusion-bounded window of Sicker Group, Myra Formation, west of Muchalat Lake. Previous work on the property has shown that the known Falls, Dragon and Norgate Creek mineral showings are located in a package of altered felsic volcanic rock near the stratigraphic top of the Myra Formation. Westmin has focused most of its attention on this package and traced it for a distance of approximately 3.5 km from the Muchalat River valley into the Norgate Creek area. The rocks are altered and mineralized at several localities along strike. They have a relatively shallow dip to the east, towards a probably cross-cutting intrusion.

Westmin's 1996 program tested the potential of the altered and mineralized felsic unit in the Norgate Creek area and looked for evidence of additional volcanogenic massive sulphide potential lower in the stratigraphic section. The company reopened three of the holes drilled in the Norgate Creek area in 1995, conducted down-hole geophysical surveys and located an attractive off-hole anomaly. It also mapped and sampled much of the exposed Myra Formation to the

east of the mineralized unit, looking for encouragement lower in the stratigraphic section. Unfortunately, it found that the topography in the area prevented it from seeing to any great depth in the formation.

The company conducted a fall program in which it completed four diamond drill holes for an aggregate depth of 1300 metres. Two were short holes that tested the off-hole geophysical anomaly in the Norgate Creek area. They encountered weak mineralization but failed to intersect massive sulphide. The other two were deep stratigraphic holes sited approximately 2.0 km and 4.5 km due east of the Norgate Creek area and a considerable distance to the south and east of the known Dragon and Falls showings. The stratigraphic holes intersected a considerable thickness of relatively unaltered volcanic breccia that may indicate the presence of a structurally-controlled trough. However, they provided little evidence of stacked volcanogenic massive sulphide mineralization at shallow depth below the Norgate Creek mineral system.

T'SABLE RIVER COAL

Over the summer, Quinsam Coal Corporation conducted a major exploration program in the T'Sable River area, southeast of Courtenay. It drilled 27 holes for an aggregate total of 6543 metres, to test the thickness, continuity and quality of the Comox No. 1 and No. 3 coal seams in an easterly dipping block of Denman Formation between the T'Sable River and Cougar Smith Creek. The company drilled in the vicinity of and down-dip from an existing drill indicated reserve of 10 million tonnes of high volatile metallurgical or coking coal established in 1991. It added considerably to the resource, which now stands at over 30 million tonnes.

Quinsam Coal used the same rotary rig that it used at the Quinsam mine and it cored through the coal seams and geophysically logged the holes. It is currently evaluating the coal for its thermal and metallurgical properties.

Previous work on the property, and at the past-producing T'Sable River Colliery (approximately five kilometres to the north, on the north side of the T'Sable River), suggests that the two principal seams in the area (Comox No. 1 and No. 3) are separated by 10 to 20 metres of upward coarsening sediment and that the No. 2 seam is restricted to a marker horizon. The two main seams are composite and contain numerous shaley partitions. At the old mine production came from the lower seam which ranged in thickness from 1.2 metres to 4.2 metres and contained in excess of 2.0% sulphur.

The upper seam appears to be virtually shaled out near the mine.

Preliminary work to the south of the river shows similar stratigraphic relationships. The main exploration target is the lower No. 1 seam. It ranges from 1.0 metres to 4.0 metres in thickness and it has a low, generally less than 1.0%, sulphur content. The No. 3 seam is approximately 30 metres higher in the stratigraphic section. It is narrow, commonly less than 1.5 metres in width, and it is split by a major shale parting. It commonly contains in excess of 2.0% sulphur. Both seams contain medium to highly volatile bituminous coal that contains a moderate amount of coal-bed methane.

In the fall, Hillsborough Resources Limited created a subsidiary company, T'Sable River Coal Corporation, to continue with the exploration of the property. The company is currently reviewing geological and geophysical data to determine the structural integrity of the deposit. It is also conducting base-line environmental studies and is developing preliminary plans for accessing the coal, in the event that the product proves marketable.

TAY

Further south, Dalmation Resources Limited is looking for economically viable, free-gold bearing ore-shoots in quartz-carbonate veins in shears and splays emanating from the Taylor River - Ursus Creek fault zone. It flew 1106 line kilometres of airborne geophysical (electromagnetic, magnetometer and radiometric) survey over deformed Karmutsen Formation strata on the Tay property, near the west end of Sproat Lake and identified numerous anomalies for follow-up work in 1997.

MACKTUSH

SYMC Resources Limited has explored for precious-metal enriched quartz veins on the Macktush property, west of Alberni Inlet, since the late 1980s when it first trenched and drilled the Fred and Dave veins. Since then, it has identified numerous additional veins and porphyry-type copper and molybdenum showings. Both appear to be related to a late, post orogenic, "porphyry-copper" mineral system.

The mineralized veins are commonly located in persistent and traceable shear zones. They comprise complex quartz stockworks that incorporate slivers and blocks of deformed country rock. The veins are locally banded and colliform and they contain drusy cavities. They also contain disseminations of fine-grained pyrite, pyrrhotite and chalcopyrite and trace amounts of bornite

and tetrahedrite. Metal values tend to be remarkably consistent both within a given vein and from vein to vein. Company data indicate that the Fred and Dave veins average approximately 15.0 grams per tonne gold, 60.0 grams per tonne silver and over 1.0% copper across mineable widths. Preliminary metallurgical test work suggests that the gold is both free-milling and tied up in sulphide.

The Macktush veins are located in deformed granodiorite and sheared basalt close to a regionally extensive northwesterly-trending contact between an Island Intrusion batholith and rocks of the Karmutsen Formation. However, they are markedly discordant to the contact. Most have a northeasterly strike and a moderate to steep dip to the southeast. Individual veins range up to several metres in width depending on the size of the shear they inhabit, but the larger ones average approximately 1.5 metres in thickness.

In 1996, the company continued with its ongoing trenching program on the Fred and Dave veins and traced them for a considerable distance up hill, to the southwest. The Dave vein extends for a minimum distance of 250 metres and the Fred vein extends for a minimum distance of 450 metres.

COUS CREEK

Ashworth Exploration Ltd. was also active on the west side of Alberni Inlet. It explored the Skarn 3 claim, on Cous Creek. The company trenched a northwesterly trending shear zone that cuts massive porphyritic andesite, or basalt, approximately 1000 metres to the south of, and on strike with, a complex (and probably associated) skarn deposit that was last explored in the 1980s.

The eleven trenches exposed a broad and persistent, silicified and quartz-veined shear zone over a distance of approximately 140 metres. The shear zone is intruded by a late, post-orogenic, rhyolite or dacite dike that may be responsible for the silicification. The veins contain appreciable amounts of disseminated to semi-massive pyrite and pyrrhotite, minor amounts of chalcopyrite and sphalerite and erratic, but appreciable, amounts of gold. The company ran magnetometer and induced polarization geophysical and soil geochemical surveys, and traced the mineralized shear zone for a considerable distance to the south.

LUCKY/TOQ

Consolidated Logan Mines Limited has a large land position in the Toquart River area, east of Kennedy Lake. In 1995, it drilled a geophysical conductor in the Toquart River valley and located a pyritic sulphide stockwork in volcanic rocks mapped as part of West

Coast Complex. The company felt that the stockwork was probably intrusion-related and shifted its exploration focus from volcanogenic massive sulphide to porphyry copper-type mineralization. Prospecting in the fall located a new gold showing on the east slope of Mount Redford, approximately 3.0 km east of the past-producing Brynnor magnetite skarn deposit.

In 1996, Consolidated Logan flew an airborne magnetometer survey and conducted ground follow-up programs. Work to date suggests that the Mount Redford showing is a broad zone of stockwork sulphide mineralization in altered, silicified, diorite near the junction of two major faults. The sulphide stockwork covers an area approximately 800 metres wide and 1800 metres long. It contains locally abundant arsenopyrite and erratic high values of gold. Grab samples are reported to grade up to 3.21 grams per tonne gold.

JASPER

Inspiration Mining Corporation optioned the Jasper volcanogenic massive sulphide property southwest of Nitinat and carried out a comprehensive ground exploration program. It established a grid over the principal massive sulphide showing on Jasper Creek, mapped the area, and conducted geophysical and soil geochemical surveys that located several anomalies. It also identified a felsic dome complex within rocks previously mapped as being Lower Jurassic, Bonanza Formation. The company located several new showings and established numerous targets for future exploration.

VALENTINE

Beau Pre Explorations Limited built a small mill on Valentine Mountain and processed a small part of a bulk sample previously mined from the Discovery zone "C" trench. It ran approximately 70 tonnes of gold-bearing, quartz-veined meta-sediment through a simple ball mill and shaking table circuit to establish the grade of the mineralization. The results indicate that the quartz stockwork has an average grade of 9.9 grams per tonne over a width of 1.0 metre.

The program confirmed the "nuggety" nature of the vein system and established that gold occurs in grains that range in size from 0.04 mm to 6 mm in diameter. The existing circuit was only able to recover approximately 60% of the gold but the company feels that it can achieve far greater recoveries by adding either an enhanced gravity separation or a flotation circuit.

OTHER ACTIVITY

There were numerous smaller exploration programs on Vancouver Island and on Texada Island. These include: geophysical and geochemical programs by Redell Mining Corporation on the Reko skarn property near Port Renfrew; mapping by Ecowaste Industries Limited on the Var limestone property near Holberg Inlet; reopening and exploration of the past-producing Lake Adit magnetite mine on Texada Island by Vananda Gold Limited; and a small amount of drilling on the Craft "white" limestone property near Benson Lake by Raging River Resources Limited. There were also a number of early-stage prospecting programs, some of which were partially supported by the Ministry's Prospector Assistance Program.

SOUTHERN COAST

It was a particularly active year for exploration in the Southern Coast area and Lower Mainland. There were more projects, both large and small, than in most recent years and there were some notable exploration successes.

LADNER CREEK

Athabaska Resources Limited hopes to reactivate the Ladner Creek (Carolin) mine, near Hope. In 1995, it reopened the mine and started an underground drill program that was designed to trace and extend a series of ore-shoots in Ladner Group meta-sedimentary strata immediately to the east of the East Hozameen fault. Drilling continued over the winter. Early in 1996, the company completed 32 underground diamond drill holes for an aggregate depth of 2573 metres. The program increased the known fully diluted mineable reserve at the mine to 1.36 million tonnes grading 4.42 grams per tonne gold. It also located several new ore-shoots, including one in volcanic rock that was unusually high in grade (11.32 grams per tonne gold over 9.0 metres

Athabaska was encouraged by the results and recommenced drilling in July. Over the summer, it completed a further 24 underground diamond drill holes for an aggregate depth of 3817 metres. The holes were designed to increase confidence in the dimensions of the known ore-shoots and to test the size potential of some of the newer targets. The company also trenched across the surface projection of one of the lenses to determine the potential for a small open pit reserve above the Idaho adit.

The summer program added considerable tonnage to the reserve. In September, Athabaska reported a mineable reserve of approximately 1.62

million tonnes grading 4.42 grams per tonne gold containing approximately 7877 kilograms of gold. The amount was calculated using 2.74 grams per tonne gold cut off, a 3.0 metres minimum mining width, and 15% dilution at 1.0 gram per tonne.

In addition to providing tonnage and grade data, the drill holes have supplied a considerable amount of new geological information. They suggest that the best grades and thicknesses are to be found in altered meta-sediments underlying massive volcanic rock in the immediate footwall of late, shallow-dipping faults such as the Richardson fault.

The gold at Ladner Creek is exceedingly fine-grained and it is tied up in sulphide. The previous operator had problems recovering the gold and had trouble handling the cyanide it used in the extraction process. Athabaska has conducted comprehensive metallurgical tests and determined that there is no need to use a cyanide-based extraction process. The tests show that it can achieve recoveries of approximately 85% by grinding to -200 mesh and producing and shipping a flotation concentrate. This not only provides a far better recovery than that achieved by its predecessor but it greatly reduces the potential for environmental concern.

Given that the old mill is on site, the company expects to reopen the mine at very moderate cost, some of which it hopes to recover through the reprocessing of tailings during the first year of production. It estimates that the pond contains approximately 600 000 tonnes of recoverable tailings grading 1.75 gram per tonne gold.

MACMASTER

As part of its program to delineate additional reserves for the Ladner Creek operation, Athabaska Resources Limited completed a further nine diamond drill holes totalling 1057 metres. The holes were drilled, from surface in the MacMaster Pond area approximately 1.5 km north and at a higher elevation than the Ladner Creek mine-site.

Athabaska drilled the holes in response to a particularly encouraging intercept located in 1995. One hole had intercepted a thick section of bleached, albitic mineralized meta-sediment that was visually and mineralogically very similar to material found at the main Ladner Creek deposit. The intercept ran 5.07 grams per tonne gold over 12.92 metres.

The 1996 program was designed to establish the grade, continuity and down-dip extent of the zone, which lies in the footwall of the MacMaster Pond fault, immediately below a barren but talcose lens of serpentinite. The fault is a shallow, north-easterly

dipping structure that off-sets the East Hozameen fault and places massive volcanic strata of the Spider Peak formation on top of deformed Ladner Group siltstones.

The company extended the zone along strike and to depth and calculated preliminary reserves. It estimates that the zone has an open pit reserve of 186 000 tonnes grading 1.89 gram per tonne gold and a minimum underground reserve of 240 000 tonnes at a diluted mining grade of 4.42 grams per tonne gold. The zone remains open along strike and to depth. Depending on its plunge, it may or may not be easy to trace from surface as drill depth in the MacMaster area is strongly influenced by topography. The company may eventually collar an adit lower on the hillside and access the lens from underground.

Athabaska's success at MacMaster not only increases the immediate reserve available for the Ladner Creek mill but it provides considerable encouragement for further exploration on the property. There are numerous untested or incompletely evaluated gold showings and gold in soil geochemical anomalies on the property. The company plans to test more of them in the coming year.

GIANT COPPER

Imperial Metals Corporation explored the Giant Copper property, which straddles the southern extension of the Hozameen fault system, approximately 50 km south of the Ladner Creek mine-site.

The Giant Copper property is in a window of resource management land surrounded by protected areas. It is bounded by Ernest Manning Provincial Park to the east and by the newly created Skagit Valley Provincial Park to the west. The property was excluded from protection because of its mineral potential. In fact, the decision that created the Skagit Valley Park, in 1995, specifically returned the part of the property that was previously within the Skagit Valley Recreation Area back to resource management land. The announcement ensures the company's rights to explore and develop in the Skagit valley "doughnut-hole".

Imperial flew a 659 line kilometre airborne geophysical survey and conducted ground follow-up mapping and stream, moss-mat geochemical surveys over the full extent of the Giant Copper property. The program was designed to establish a broad-based geological setting for the principal showings, which include the AM zone, the past-producing Invermay zone and other previously identified rock and soil geochemical anomalies. Thereafter, the company focused much of its attention on exploring the relatively

poorly known Invermay mine area, which had hitherto been tied up in the recreation area.

The Invermay mine produced a small amount of hand-cobbed lead, zinc, silver, gold and copper ore in the 1930s. Production came from adits that were driven into a tight, steep northeasterly trending, tourmaline-sulphide vein that cuts an igneous intrusion known as the Invermay stock. Imperial's interest in the area stemmed from old underground drill reports that showed that the host rocks adjacent to the vein are brecciated and contain low but consistent grades of copper. The company constructed a grid over the zone and ran ground geophysical (induced polarization, electromagnetic and magnetic) and soil geochemical surveys that located broad chargeability geophysical and coincident copper, gold and arsenic soil geochemical anomalies.

Subsequently, the company drilled 16 diamond drill holes totalling 2835 metres. The first two holes were drilled to test a geochemical anomaly in the Avalanche area. The results were inconclusive as they were collared in a fault zone. The remainder explored the Invermay zone, where they located an irregularly-shaped body of variably mineralized plutonic breccia cut by a felsic dike swarm. Many of the holes returned broad intercepts of weakly to intensely potassically altered, silicified and tourmalinized breccia with encouraging values of copper, gold and silver. One intercept assayed 0.32% copper, 0.33 gram per tonne gold and 43.9 grams per tonne silver over 53 metres. Imperial has calculated a preliminary geological resource for the Invermay zone of 15.33 million tonnes grading 0.21 % Cu, 0.38 g/t Au and 8.74 g/t Ag.

The data suggest that the vein mined in the 1930s is superimposed upon a zone of tourmalinized, porphyry copper-type alteration and mineralization. The zone appears to be open to the northwest.

SENECA

International Curator Resources Limited was also active in the southern part of the province. It conducted induced polarization and other geophysical surveys over Harrison Lake formation strata in the Chehalis River valley, north of Harrison Mills. The company is exploring for a Kuroko-type "massive sulphide" deposit on strike with known mineral occurrences at Fleetwood, Vent and Seneca.

The "massive sulphide" potential of the Seneca property was first recognized by Cominco Limited in the 1970s when it noted the conformable nature of the Seneca deposit, a fragmental "massive sulphide" unit that has a geological reserve of 1.5 million tonnes

grading 3.57% Zn, 0.60% Cu and 0.14% Pb. Since then, several companies have explored the property and defined a broad, northwesterly trending belt of prospective, mineralized, felsic volcanic and volcanoclastic rock that extends up the Chehalis River valley.

The geophysical program located a strong chargeability anomaly approximately 3.0 kilometres to the northwest of the Fleetwood zone. The anomaly is an attractive step-out target which the company hopes to drill in 1997.

LD

Flame Petro-Minerals was also active in the Harrison Lake area. The company drilled seven diamond drill holes totalling 823 metres, to test a northeasterly trending, coincident gold and silver soil geochemical anomaly near the old Rye adit. The drill holes intersected intermediate to felsic volcanic rocks of the Harrison Lake formation. The rocks are weakly deformed and cut by veins of quartz and carbonate that commonly contain a trace amount of pyrite. They are also cut by a second generation of distinctive watery quartz veins that contain pyrite and galena. The latter appear to carry gold. One drill intercept is reported to have run 5.47 grams per tonne gold over 5.0 metres.

BRANDYWINE

La Rock Mining Corporation has located an irregularly shaped gold zone at Dave's Pond, on the Brandywine property near Whistler. It appears to consist of an irregular, funnel-shaped body of sheared, quartz-carbonate altered, mineralized meta-volcanic strata. The precise controls on the mineralization are uncertain.

The Dave's Pond deposit is located within a large area of anomalous gold soil geochemistry that includes several other showings, including the past-producing Main and Silver Tunnel zones and the McKenzie Mill prospects. In 1996, La Rock broadened its exploration focus and drill-tested several geological, geochemical and geophysical targets within the overall geochemical anomaly. It diamond drilled thirteen holes totalling 1435 metres. Three of the holes were collared in the McKenzie Mill area, two were collared at Dave's Pond and the remainder were sited on the 1.5 kilometre length of hill-side in-between. Some of the step-out holes intercepted narrow, but interesting zones of alteration and mineralization.

JJ

There was appreciable exploration interest in the Jervis Inlet area north of the Sechelt Peninsula in 1996. Aquaterre Mineral Development Limited was active in the area, looking for a volcanogenic massive sulphide deposit in a Gambier Group roof pendant in the Coast Plutonic Complex. In 1993, it staked a known copper soil geochemical anomaly on a steep forested slope to the north of Saumarez Bluffs on the west side of the Inlet. The company re-gridded and re-established the soil geochemical anomaly and ran geophysical surveys that identified a series of northwesterly trending, coincident, parallel, linear, induced polarization anomalies.

In 1996, Aquaterre drilled two diamond drill holes totalling 832 metres from two reasonably easily accessible sites topographically above and to the west of the main anomaly. It drilled down-hill to the east looking for evidence of volcanogenic massive sulphide mineralization within the pendant rocks. The holes intersected fine-grained volcanic and sedimentary strata cross-cut by feldspar porphyry dikes. The rocks are highly fractured and cut by a variable but locally intense pyrite stockwork. One of the holes also returned a narrow intercept of chalcopyrite bearing tuff that ran 1.9% copper over 0.3 metres.

The company feels that the pyrite stockwork probably accounts for the chargeability anomaly. However, it also feels that the narrow intercept of chalcopyrite is unlikely to be the only source for the copper soil geochemical anomaly. There is another alternative. Prospecting to the north of the geophysical grid has located an area of scattered chalcopyrite and molybdenite mineralization in feldspar porphyry. The anomaly may be glacially transported from a "porphyry copper" target.

Aquaterre remains encouraged by the presence of bedded chalcopyrite and by significant enrichment in volcanogenic massive sulphide indicator elements such as zinc, lead, silver and barium in some sections of volcanic and sedimentary rock. It still feels that the pendant rocks may host a volcanogenic massive sulphide deposit. It plans to explore both possibilities in 1997.

ROX

Navarre Resources Corporation also carried out a drill program in the Jervis Inlet area. The company flew a small drill into a ridge-site on a steep slope above No Man's Creek on the east facing slope of Mount Diadem, and drilled a series of holes to sample a high-grade, gold-bearing, quartz-sulphide vein in a Gambier

Group roof pendant. The exploration site is less than 1000 metres from the Skwim Lake property, where Anaconda Canada Exploration Ltd. explored for volcanogenic massive sulphide mineralization in the mid-1980s.

Prior to drilling, Navarre traced the principal vein for a distance of approximately 500 metres. The vein appears to be one of many located in tight, northeasterly striking, near-vertical shear zones. It has variable width but is, most commonly, fairly narrow (0.2 m - 1.0 m). It has sheared contacts and is locally rich in sulphide which occurs as irregular blebs and pods of pyrite and/or pyrrhotite, chalcopyrite, sphalerite and galena, and it carries free gold. Grades are variable but locally reach values of several ounces per tonne over narrow (0.25 metre) widths.

The company diamond drilled eight holes totalling 547 metres and intersected the vein at shallow depth below last year's trenches. The gold grades derived from the core were lower than those found in the trenches but were sufficiently enriched to encourage more exploration. Given the steepness of the slope, the company is contemplating drilling a series of horizontal holes a considerable distance down slope in order to trace the vein to depth.

RUBY

Menika Mining Limited is exploring for similar gold-bearing, quartz-sulphide veins on the old Chalice property at Ruby Lake, near Egmont, at the north end of the Sechelt Peninsula. The company conducted a geophysical survey and started a follow-up drill program. However, it was short lived. It shut down in response to local residents complaints about noise. The company diamond-drilled four holes totalling 725 metres. It expects to finish the program using a quieter drill in 1997.

Menika is exploring a wide-spaced series of narrow, steeply-dipping, northeasterly trending veins and breccia zones that cut plutonic and volcanic pendant rocks near Ruby Lake. The veins are rich in pyrite and/or marcasite and contain trace amounts of chalcopyrite. They carry erratic, locally highly elevated values of gold and silver. Previous operators reported finding scattered chalcopyrite and molybdenite showings on the property and Menika also located a new occurrence slightly to the north of the North Lake road.

SALAL

The Salal Creek molybdenum deposit is located in a deeply eroded, Miocene-aged, quartz

monzonite intrusion approximately 25 kilometres northeast of Mount Meager. It was discovered in 1960 and it was explored extensively in the 1970s and early 1980s. Verdestone Resources Limited and Molycorp Gold Corporation have restaked the property and resumed exploration.

The Salal Creek stock is roughly circular in outline. It is a composite intrusion largely composed of an older outer ring of coarse-grained quartz monzonite and a younger inner stock of finer-grained and porphyritic quartz monzonite. The contact between the two is crudely circular in plan view and approximately 5.0 km in diameter. The central stock appears to have intruded and domed the earlier phase, causing it to be intensely fractured and "prepared" for the emplacement of still younger phases of the intrusion and for later mineralization. The deposit comprises several discontinuous zones of fracture and quartz vein stockwork molybdenite and pyrite mineralization located around the contact between the inner and outer phases of the stock.

Verdestone Resources drilled two diamond drill holes totalling 489 metres from a very rugged site near the head of Float Creek, on the south side of the ring. It is looking for high-grade molybdenite at depth under one of the better known of the previously explored showings. The results were inconclusive as the holes did not penetrate as deeply as intended. However, they suggest that in that particular area molybdenum grades do in fact increase with depth. The company hopes to deepen one of the holes and continue to explore the property in 1997.

OTHER ACTIVITY

There were several other exploration programs in the Southern Coastal area. Ashworth Engineering hand-trenched some quartz veins on the Nugget Queen property near Seymour Inlet; Tiberon Minerals Limited ran a grid sampling/mapping survey on the Elk claims on Bute Inlet; International Tika Resources Limited conducted a small grid program on the Earle/Treat claims on Jervis Inlet; Aquistar Ventures Limited conducted a similar grid program over a quartz vein system on Sonora Island; and Canquest Resources Corporation drilled a short hole into a breccia zone on the O.K. porphyry copper property near Powell River.

LAND USE

VANCOUVER ISLAND

In February, the provincial government created thirty five new "goal two" protected areas on

Vancouver Island and in the immediate surrounding area. The new parks were selected as being small sites of special environmental, recreational or cultural interest. They vary in size from 14 hectares at Mesachie Lake to 3000 hectares at Chain Lakes on Quadra Island. Together, they amount to 11 857 hectares and bring the overall level of protection on Vancouver Island up to 13%. The new parks complete the protected areas selection process for Vancouver Island.

SOUTHERN COAST

In October, the provincial government created twenty three new protected areas in the Lower Mainland Region, which extends as far north as Bute Inlet. Eleven of the areas are large, "goal one" sites primarily selected for their ability to represent their eco-sections. They include Bishop River, Elaho/Clendenning, Mehatl and Upper Lillooet. The remainder are small "goal two" sites selected for their natural features and recreational values. They include Brackendale Eagle Reserve, Homathko Estuary and Yale Garry Oaks. The new sites add approximately 136,000 hectares to the land protected in the Lower Mainland and bring the overall level of protection up to 14%.

This land-use decision completes the protected areas selection process for the Lower Mainland. Crown land management issues will be addressed in a series of Land and Resource Management Plans or other sub-regional planning processes.

In July 1996, government announced the forthcoming development of a Land and Resource Management Plan for the Central Coast north of Bute Inlet. This planning process will lead to recommendations concerning both protected areas and Crown land management in that portion of the coast mountains.

GOVERNMENT ACTIVITY AND RESEARCH

As part of the Ministry's program of highlighting areas of exploration interest, Gerry Ray of the Geological Survey Branch mapped volcanic rocks in the vicinity of the Nifty "massive sulphide" deposit near Hagensborg east of Bella Coola. The program was directed at establishing the age of the pendant rocks and the metallogenic significance of the mineralization. The Nifty deposit is comprised of a central zone of intense silicification and pyritic stockwork mineralization and an apparently discontinuous, overlying and flanking stratabound barite cap that is enriched in zinc, lead and silver. It appears to be a relatively low temperature

volcanogenic exhalative deposit formed in a shallow submarine environment.

The Geological Survey of Canada is working on several projects designed to assess the importance of natural hazard to the region. In 1996, John Clague compiled and released a bulletin on the paleoseismological and seismic hazards in Southwestern British Columbia and Mark Stasiuk et. al. produced a bulletin on the 2400 BP eruption of Mount Meager. The natural hazard assessment program is likely to continue for some time to come.

The Geological Survey of Canada has recently completed several mapping projects in the Southern Coastal region and expects to release several new map products in 1997. They include an improved 1:250 000-scale colour geology map of the Bute Inlet area, by Jim Roddick and an integrated digital geoscience database for the Vancouver, Hope, Ashcroft and Pemberton map areas prepared by Murray Journey. Both will add considerably to the geoscience database for the region

ACKNOWLEDGMENTS

The author wishes to acknowledge the contribution of numerous public and private sector geologists and other professionals to this report.